Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

Published by McGraw Publishing Company, Inc.

Volume 72 NEW YORK, SATURDAY, DECEMBER 11, 1915 Number 24

The President's Message

DISCUSSION and more or less authoritative interviews had given the country some insight in advance into the military preparedness program outlined by the President in his annual message to Congress last Tuesday. The closing paragraphs, however, outlined a broader program for effective defense than had hitherto been hinted at from official sources, though suggestions regarding it had come from various societies and individuals. The President points out that there must be possible a mobilization not only of the country's military resources, but of its economic resources as well. Railroad experts, manufacturers and the leaders in technology must be brought in touch through systematic consultation with the directing officers of the army and the navy, in order that no means of strengthening ourselves for a contest may be overlooked. In making these suggestions the President is but repeating the ideas advanced by Mr. Dixon, on page 737 of this issue; the industrial preparedness program outlined by Martin J. Gillen, which was described in this journal Nov. 13, 1915, page 589, and the views expressed by various engineering bodies—excellent suggestions, all of them, to which the engineering profession will heartily say "amen."

For the Railroads

THOUGH his language is carefully guarded, it seems evident that the President at the end of his address was pleading for a cessation of anti-railroad legislation. He does not say that the railroads have been persecuted, he does not antagonize the radical element that has mercilessly persecuted the carriers; he pleads only for fairness, a study of the whole problem "in the full light of a fresh assessment of circumstance and opinion." He asks that a commission be appointed to investigate the railroad situation and that legislation await its conclusions. In theory no one could differ with this proposal. In practice one despairs of any good result, not only because the problem is so tremendous, but because any such commission appointed through Government agencies is sure to be overloaded with theorists. Practical railroad men seem to be taboo as advisers of the Government in its dealings with the railroads.

Planning with Pins

AT every turn the picture is demonstrating its usefulness as a means of conveying at a glance information which it would take pages of text to explain. But in spite of daily reminders from the press and the screen, engineers have been slow to adapt the pictorial form of recording facts to their own work. That it holds great possibilities as a time saver in aiding the administration of large-scale engineering operations is apparent to one who reads the story of Mr. Connell's planning board for the work of the Philadelphia Bureau of Highways. The planning board is essentially a picture—a large map of the city street system, on which the status of paving work involving 750 contracts is represented by pins of various sizes and colors. A white pin, for example, may indicate that contracts have been authorized, a red pin that work has started, a yellow pin that resurfacing is needed, and so on. With the pins adjusted each morning a composite picture of the work of the entire highway bureau is available at a glance, a result impossible of attainment with printed records of progress. Then, too, the planning board shows up, as no other method can, unbalanced work—the concentration of activities in one section of a city while other districts, fully as much in need of improvement, are neglected. It is also invaluable in routing new work. While it is applied, in Philadelphia, to highway administration, the planning board idea can be used in practically every line of engineering activity. The Philadelphia executives are so enthusiastic about its success that engineers elsewhere will do well to study its possibilities in their own offices.

Wet-Batch Rating for Mixers

IT IS a source of gratification that most of the manufacturers of concrete mixers now rate their machines on a wet-batch basis. That is, a machine called in their catalog a ½-yd. mixer will actually hold ½ yd. of mixed concrete, ready to be carried to the forms. Contractors without number have bought machines which they thought would give them ½ yd. of mixed concrete, only to find that the manufacturer based his machine on the volume of the unmixed material. These bulk larger than when incorporated as concrete, so that the actual output of a mixer rated on dry-batch measurement is less than the stated rating. There are still a few manufacturers who adhere to the former policy, but with few exceptions the wet-batch rating is now employed. The latter is the more logical in that it is the truer measure of what the plant can be expected to do in service.

Tribute to James B. Francis

ONE of the most pleasing tributes to an engineer to be found in contemporary technical literature is the article on James B. Francis in the 1914-1915 number of the annual historical volume published by the Verein Deutscher Ingenieure. It is written by Dr. Karl Keller of Munich, and is prompted by the fact that this year marks the hundredth anniversary of Francis' birth—a fact almost wholly overlooked in this country. The appreciation occupies fifteen pages of the volume, and describes interestingly, though briefly, considering the magnitude of Francis' work, the noted experimenter's developments in hydraulic lines. Chief attention is given, of course, to the development of the Francis turbine. The article closes with the following quotation: "As long as water shall find its way to the valleys, there to be used in turbines, the name of James Bicheno Francis will stand as that of a great hydraulic engineer." One cannot but feel gratified that amid the terrible tumult of the European war, scientific men can rise above the strife and bickerings to acknowledge the worth of work outside their borders, even among those who may have incurred the displeasure of the scientist's own people.

The Broad View

RAILROAD terminal problems are admittedly among the most complex which the railroad engineer is asked to handle. Obviously, they require thorough familiarity with terminal needs and a board grasp of railroad and municipal problems. In taking up the railroad situation in Dallas, Tex., John F. Wallace might have contented himself with the separation of the 160 grade-crossings in that city, preserving the present alignments, and with working out over- and under-crossing designs with a view to economy from the standpoints of construction and property damages. In fact, in his report, abstracted on page 722 of this issue, he does treat the problem comprehensively from this point of view. However, with a thorough understanding not only of railroad terminal needs, but of the municipal problems that hamper or make for the good of a thriving and aggressive city, he breaks away from this narrow consideration of the problem, and has shown the possibility of something better for the city than a network of elevated railroads cutting it up for all time. The conditions lend themselves admirably to the throwing of an intercepting belt line around the greater part of the city and shutting the bulk of the railroad traffic out of the inclosed area. A study of the plan showed it to be by far the best solution both for the railroads and for the city. He has taken even one further step, for he has pointed out how some of the rights-of-way can be turned into broad through streets, and made the framework of a real city plan. The conditions in Dallas seem to be quite favorable to the plan outlined. It is not so difficult at almost any city to intercept through freight business and send it around the city, nor to carry all passenger trains over one line to a union station. It is not often, however, that all local freight terminals are so placed near the loop and each other as to form virtually one terminal district immediately inside of the belt system. Nevertheless full credit must be given to the broad character of a study which has ended in what appears to be a satisfactory solution from the standpoint of the immediate needs of the railroads and the city, and at the same time will greatly benefit the latter in its future development.

City Plan Supreme

IN CASE the belt line proposed by Mr. Wallace at Dallas is built, it will be interesting to see how long it will be before the tracks disappear from their present locations, if they ever do. In general, neither individuals nor corporations are educated to the making of sacrifices for the good of the city plan. The Dallas railroads that have the best locations will presumably object to surrendering their advantages, just as the industries along them will oppose being ousted. Even though new industries be forced to locate in the segregated districts, the old ones will doubtless want to expand; renewals of plant and equipment will be constantly going on, and a sharp line will have to be drawn somewhere. At Chicago, when the union station question was up, the railroads generally agreed that the line could not be drawn, and the resulting ordinance was something of a compromise. Nowhere else, however, is the problem as big or as complex as at Chicago. Mr. Wallace's proposal for Dallas is novel but rational. It seems only a question of time and education until the city plan is made supreme. Some European cities have already made it so.

What the Exposition Accomplished

LAST week the Panama-Pacific Exposition passed into history. Time must elapse before its influence can be rightfully gaged, but even now some of its accomplishments may be noted, for they stand out strongly and unmistakably. Probably the most important of its results is the better understanding in the East of the spirit and ambitions of the Pacific Coast. This is due to the advertising which the Coast received through the medium of the exposition and also through the visits of people from east of the Rocky Mountains. The number of Eastern visitors, it is true, formed a comparatively small percentage of the total number that passed through the exposition gates. Each of these visitors, however, on returning East is sure to spread his enthusiasm for the West and its people. As for the advertising, it is estimated that the publicity which San Francisco and the Coast received through the publication of special editions of magazines, colored supplements and newspaper and magazine articles, was equal in value, if it could have been purchased, to the total cost of the exposition itself. As an educational force, too, the exposition had high rank. Its value in this respect cannot at present be estimated. Finally, it must be said to the credit of the Coast that the exposition was entirely a Western product. Its success has been on the large scale for which the West is noted, the mere fact that it did not run behind financially making it stand out as a wonder in exposition history. This thought, too, should be coupled with an understanding that, unlike Chicago, Buffalo and St. Louis, a coast city has a tributary area which is a semi-circle, so far as available attendance from the vicinity is concerned. While in dollars and cents San Francisco may have made a good bargain in holding the exposition, the real accomplishment, even the Coast willingly grants, is far larger. The gulf between East and West is a step nearer to being bridged. Sympathy will be closer, divergent business points of view better understood, and greater unity insured for the carrying out of whatever projects the nation as a whole decides to adopt.

The Taxpayer and the Engineer

THE ADMINISTRATION of city government in America is often such that the taxpayer is continually losing money which the engineer ought to save him. Two flagrant examples of this sort have just come to public attention in New York City. Perhaps it is not fair to cite New York, as the arrangement in force there of having a State commission administer some strictly city affairs necessarily causes delay.

The city will lose heavily on the change of a rapid-transit route from the Queensboro Bridge to a new tunnel to be constructed for the crossing. The city depended on a contractor's offer to submit a bid not greater than a certain sum for the work. The facts overlooked, that the city could not accept this offer without advertising for competitive bids, and that gathering the information for other contractors to bid on would take not weeks but months, have caused a condition that will make the change more expensive than was counted on. Prices of steel and other materials have advanced by leaps and bounds, and the work cannot now be done for anything like the estimate of ten months ago. Indeed, the contractor has already called the city's attention to the fact that the time limit of six months on his offer expired last August. It will be remembered that the city itself delayed action on the matter for many months after the proposal was first made.

Again, in the matter of right-of-way for a pair of lower East River tunnels the State commission had driven a bargain with a certain dock company whereby the city would acquire at no expense to the taxpayers rights that will now cost them half a million in cash, and a further sum for extra construction expense. The city was to exchange property worth much more to the dock company than to the city for the right-of-way, with a cash consideration. This consideration was balanced by the agreement of the dock company to construct its new piers over the tubes, so that a sum about equal to the cash consideration, which would otherwise have to be spent to protect the shore ends of the tubes from damage by vessels, would be saved the city. Dilatory tactics indulged in by the city have caused the offer to be withdrawn. The public will never learn the lesson of such examples unless the engineer drives it home. The politicians are not interested in exposing their own mistakes. Engineers and engineering bodies who have popular influence or access to the daily press should not hesitate to use these means for a campaign of education. Such a campaign alone can put public management of engineering works on a better basis.

Preparedness—Its Application to Contract Work

PREPAREDNESS is the watchword of the minute. Its chief significance now bears on our military and naval establishments. To the civil engineer and contractor it should, however, have an added meaning—preparedness for a construction season which promises to be beset with unprecedented difficulties.

The situation has been emphasized in editorials in this journal the last two weeks. It will bear brief restatement. The steel market has risen sharply, so that higher prices must be expected next year, while the congestion at the mills is such that it is impossible for them to accept orders for early delivery. Four to six months are the terms now being quoted. The consequence is that important work will surely be delayed unless contracts are let for it immediately.

Nor are conditions, so far as the consumer is concerned, improving. Prices are still going up, while the quoted deliveries are later each week. Not only will it be difficult to secure the steel actually going into construction, but manufacturers of contractors' plant will probably have difficulty in getting adequate supplies. Already there is complaint on the latter score.

Under these conditions it is due the engineer and the contractor to be prepared—to get into the market just as soon as possible. That can only be done if the engineer will recognize his responsibility and see to it that his contracts are let at once.

Some engineers, evidently, are appreciating the situation, for contracts for tremendous tonnages of structural steel were placed in October and November. One fabricating plant reports that in the past three weeks it has closed a larger tonnage than ever before in its history, and that much of the volume was from those who ordinarily do not come into the market until late in February or early in March.

On the average, prices for reinforcing bars and shapes range 50 per cent higher than at this time last year. Other construction materials, undoubtedly, will move up in sympathy. In fact, the movement in cement prices is now well under way.

As an indication of what will happen in the equipment field, one manufacturing concern has recently announced that its new catalog would show price advances of from 40 to 60 per cent. Other manufacturers of contractors' plant, who are paying high prices in order to have available the necessary stock, will certainly be obliged to pass the increase along to the purchaser.

From every point of view, therefore, it is urgent that the engineer should act at once upon his contracts. He is the pivotal factor in the situation. He controls it absolutely, for no contractor will invest in new plant until his contracts are in hand. Furthermore, manufacturers of equipment cannot well forecast the probable demand for their products until the engineer has signified what he proposes to do.

The engineer has a professional duty to his client, whether it be a private company or a governmental organization, to get into the market just as soon as possible. Delay is sure to be penalized.

Expenditures for Highways in the United States

THE Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture has issued recently a circular (No. 52), the value of which is not to be measured by its modest size and appearance. The circular, prepared by the Division of Road Economics, presents for the first time a comprehensive statement of road expenditures in the United States. Its five pages of concise statistical information show what was spent for both local and State work in each State for 1914 (with the distribution of the State funds to administration, engineering, construction, and maintenance), the totals spent for State work since its inception, and the mileage of various types of roads, as well as the total accomplishment of the States and the mileage built in 1914 by State aid. Bringing together this information, scattered as it was through records extending over twenty years, has been a long and arduous task, and no small credit is due the Office of Public Roads for its inception and successful completion.

The circular has brought together all of the costs for State highway work so that there is a broad foundation on which to base similar data in the future. It is now possible to compare costs, progress and financial burdens of one State with another.

The statistics for 1914 are in considerable detail, requiring an almost incredible amount of labor to assemble. It would be supposed that local officials would make reports so that the State departments would have at hand information as to the cost of current work. If a given work is badly managed, to the extent that its cost records are incomplete, what is to be said for the management of the road work in nearly every State when it takes months to unearth a mass of figures which requires a corps of experts to put it into intelligible shape? It is significant that in very few States is it possible readily to secure road-cost data which mean anything. And under such lack of system there is spent annually in the United States $250,000,000. This large amount includes $75,000,000 spent under the control of the State highway departments.

The total that has been expended for State-controlled roads since their inception some twenty years ago amounted, at the close of 1914, to nearly $212,000,000. With this sum there have been constructed 35,500 miles of roads, at an average cost of nearly $6,000.

It is interesting to note the greatly increased cost per mile for 1914, when 6800 miles were built at an average cost of $11,000. This brings out forcibly the influence of changed traffic conditions—which are still in a transition stage. A very complex problem is presented that will require the best efforts of highway engineers to solve.

A study of the cost of engineering and administration in the different States is instructive. As the percentage cost for the States is not given in the Government's circular this has been computed for only a few States for our purpose. There is found to be a wide variation; thus in Massachusetts the cost is 8.4 per cent; in New York, 6.9 per cent; in California, 6; in Maryland, 3.2, and in Wisconsin less than 2 per cent. Whether these differences are due to management, to character of service rendered, or to the various systems of cost keeping, cannot be told; but there is probably more variation due to the latter than to the other two together. It is evident that there must be more uniformity in the cost-keeping systems of highway work if intelligent comparisons are to be made. Too precise conclusions, therefore, should not be drawn from these data.

The circular announces that it is the intention of the office to issue additional data as each year's work is completed. Future issues will be of increasing value, in proportion to the greater number of annual comparisons available.

Engineers' Interest in Preparedness

WHEN 300 men listen to after-dinner speeches from 9 o'clock until well past midnight without displaying the signs of unrest evoked by the usual brand of after-dinner oratory, there is just one inference to be drawn—that they are vitally interested in the subject under discussion. To anyone who was present last week at the annual banquet of the Brooklyn Engineers' Club it is clear that the technical man, as personified by this representative group of engineers, is vitally concerned in the question of military preparedness. The dinner committee of the club very shrewdly sensed this interest, and made "Preparedness" the keynote of the meeting, securing as speakers Major General Leonard Wood, commander of the Eastern Department of the Army; Admiral N. R. Usher, commandant of the Brooklyn Navy Yard, and others qualified to tell of the present status and future needs of the army and the navy, and how the technically trained man can serve his country in any program that Congress may adopt for national defense. A report of the meeting appears in the news section.

This is one way in which the engineering society can extend its field of usefulness. Primarily, of course, the engineering club or association is organized to deal with matters of strictly engineering interest, but many are now convinced that this is not the technical society's sole function. It has a large duty to perform with reference to questions of public policy. Until recently engineers have avoided these issues, largely because they were not organized to do effective work along these lines.

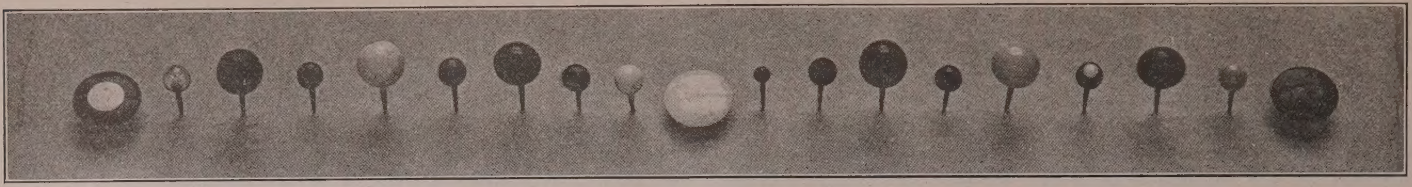
The tide is turning, and in the matter of military preparedness, depending for its effectiveness so largely upon the organization of the technical brains of the country, the engineer must play an important part. General Wood left in the minds of his Brooklyn audience no doubt as to the engineer's responsibility in the conduct of modern warfare. But in spite of the great need for his services, in case of a national crisis, there is, at present, no available machinery for preparing him in advance for the important duties which he would surely be required to perform. Every military authority emphasizes the fact that the untrained soldier is little better than useless, and yet there is no opportunity for the technical man to learn the rudiments of the soldier's duty unless he enlist for three years in the National Guard, a solution which does not carry a strong appeal to men with responsibilities which do not allow much time for outside interests.

Many engineers, however, would willingly devote a few weeks each summer to intensive training at military camps, such as the one established at Plattsburg this year. In fact, this is the plan which the joint committee of members of five of the national engineering societies—civil, mechanical, electrical, mining and consulting—has favored. At the Brooklyn dinner William Barclay Parsons, the committee's chairman, announced that a bill for an engineer reserve corps, to be recruited from men in private practice, had been drafted and would be submitted to Congress immediately. The scheme is to develop engineer officers for the reserve by brief tours of field duty and, possibly, by correspondence courses of instruction during winter. Mr. Parsons merely mentioned these two phases of the program and did not touch upon further details of the proposed legislation.

There are other ways in which the technical knowledge of the country can be capitalized for the purposes of preparedness. General Wood laid particular emphasis upon the fact that we are not giving our college students training in the fundamentals of military duty. Even students in the military institutions and the Land Grant colleges, where some training is given, are not gotten into camps of instruction under regular army officers and given the final training needed to fit them as efficient reserve officers. Harvard, Yale, Princeton and other great non-military universities have an opportunity of doing effective work in inaugurating military courses and counting these as part of the requirements for a degree, reinforcing this training by field service in summer.

The Brooklyn meeting is not the only evidence of the engineer's interest in preparedness. In addition to the activities of the national engineering bodies, the Western Society of Engineers, the Engineers' Club of Baltimore, have had preparedness meetings, while the Harvard Engineering Society of New York has appointed a committee to report on methods of military instruction for its members this winter.

These are straws in the wind. The engineer is beginning to see that he is a real factor in the Nation's defense program, and, seeing, he is laying the foundation of a course of military training, which will equip him to perform intelligently the duties of an engineer officer.



Millions for Paving Controlled by Handful of Pins

William H. Connell, Chief Engineer, Devises Planning Board Giving, on City Map, Daily Composite Picture of Status of Operations of Philadelphia Highway Bureau—Appraises Condition of 750 Contracts at a Glance

"HELLO! Is this the chief engineer? How long are you going to keep us waiting for that repaving work on Blank Street?"

An impatient Philadelphia taxpayer has phoned City Hall and is bombarding the Highway Bureau's chief, William H. Connell, with a volley of rapid-fire questions. "Is there any money available for doing the job?" the questioner continues. "Have Councils authorized the work? What kind of material are you going to use for the surfacing? How many of the streets in this territory are scheduled for repair and at what points will the work begin and stop?"

The taxpayer has sent in over the wire a large order to a very busy man. A visitor, who had been conferring with the chief when the phone bell rang, sensed the gist of the conversation and expected that Philadelphia's highway executive would employ the usual rubber-stamp methods of disposing of the inquiry by saying that he "would have the matter looked up" and answer the questions by letter when the information could be dug out of the bureau's files. Nothing of the sort happens. Instead Mr. Connell swings around in his swivel chair until he faces a huge city map, on the wall. It is not an ordinary map, for it is bristling with large-headed pins of every conceivable size and color, arranged in large and small groups and singly, with no apparent regularity. These pins Mr. Connell studies briefly, then turns to his phone and gives the taxpayer the information for which he has asked. There is no delay. The whole incident transpires within the space of a few seconds.

Planning Board a Time Saver

"You can readily see," says Mr. Connell, "what a great time saver that pin-dotted chart is. I call it a 'planning board.' Every street in the city on which work is contemplated or under way is marked with a pin whose size or color tells me all the information I need in order to know the exact status of the work in that section of town. With the entire city marked up in this way I can visualize in a moment's time how the work is going, where improvements are most urgently needed and whether I am neglecting one section of town in favor of another. It would be a hopeless task to try and get this composite picture of operations by rummaging through files and daily reports. This planning board solves the problem. It is not a toy, but a graphical clearing house of information on Philadelphia's highway work, which I find of immense value. Of course, we keep detail records of our proposed work and our contracts in the files, and it must not be assumed that the planning board can supersede these. It is, rather, supplementary to them. It discards confusing detail and presents the main facts about Philadelphia's paving work in picture form so that the data can be quickly and easily assimilated.

"You heard me give that man the information he wanted over the phone with the help of the planning board, but that is only one of its fields of usefulness. Primarily it is for my own information. It helps me route the work in my bureau intelligently and assists in laying out the schedules for my division and district engineers.

Philadelphia Paving a Big Problem

"Consider the problem we have to deal with here in Philadelphia," continues Mr. Connell. "The area of the city in 129 sq. miles; there are 1800 miles of improved streets and highways representing an asset, figured on first cost only, of $109,000,000. These city streets correspond to the 'plant' of an industrial establishment, and for keeping them in repair and new construction we are spending about $6,000,000 a year. It is absolutely necessary to keep this 'plant' in good working order, and after a paving contract is completed our real work, maintenance, begins. The operations of the bureau are on such a huge scale that before I introduced the planning board feature of keeping track of the work I often found myself lost in a maze of detail."

Mr. Connell glanced up at his board. "There is always the chance of introducing too much 'system' into the management of an office. I have seen examples of it frequently. What I mean is that one is apt to spend on systematizing more money than is justified by the results obtained. Now this planning board is nothing more than a large sheet of paper and a handful of pins which you can buy at any stationery store. One of my young engineers, receiving $82.50 a month, keeps the board up to date by spending less than 15 min. every morning changing the positions of the pins according to the developments of the previous day. The whole scheme is simplicity itself."

Every Color Has a Meaning

The planning board is the dominant feature of the chief engineer's office. As you enter the door you face it—an 8 x 10-ft. map, framed and hung on the wall with a row of concealed electric lights at its upper edge, following the lighting scheme in an art gallery. Every street in the city is shown by name on the map and is colored to indicate the type of paving. The symbols used are as follows: Unimproved roads, yellow; asphalt, blue; asphalt block, blue with black bands; concrete or granolithic, green; vitrified brick, red; slag block, red with black bands; granite block, purple; cobble or rubble, orange; macadam, brown; bituminous macadam, gray; wood block, black cross-hatching.

New paving is indicated by a dash line of the color corresponding to the kind of material used. This line is placed alongside of, and parallel to, the color area between the curb lines so that it may be readily distinguished. Obviously if the dash line were marked on the center line of the street the colors would merge and nothing would be shown, so that it is offset for emphasis. The ends of the dash line indicate the limits of the work authorized.

Pins of various kinds indicate the status of the city's paving work. On the chief engineer's board a large, white-headed pin means that a contract has been awarded and executed. When work starts the white pin is replaced by a red one. Large blue pins indicate work in progress by municipal forces and a large black pin is used as a "trouble marker."

Pins Classify Work

Pins with small, colored heads are employed for the detailed classification of authorized work. The following are the symbols for the pin markers: Green, grading; red, paving; blue, repaving; white, surfacing; brown, resurfacing; light blue, extensive repairs by municipal forces; gray, dust layer treatment; yellow, bituminous surface treatment; yellow with red dot, surface treatment urgent; yellow with white dot, material ordered; yellow with black dot, material delivered; small black-headed pin, ordinance pending; dark green, park, boulevard and special construction; large yellow pin, outstanding "tickler" (referring to reminder in letter files scheduled for attention on a specific date).

Visible Index Supplements Map

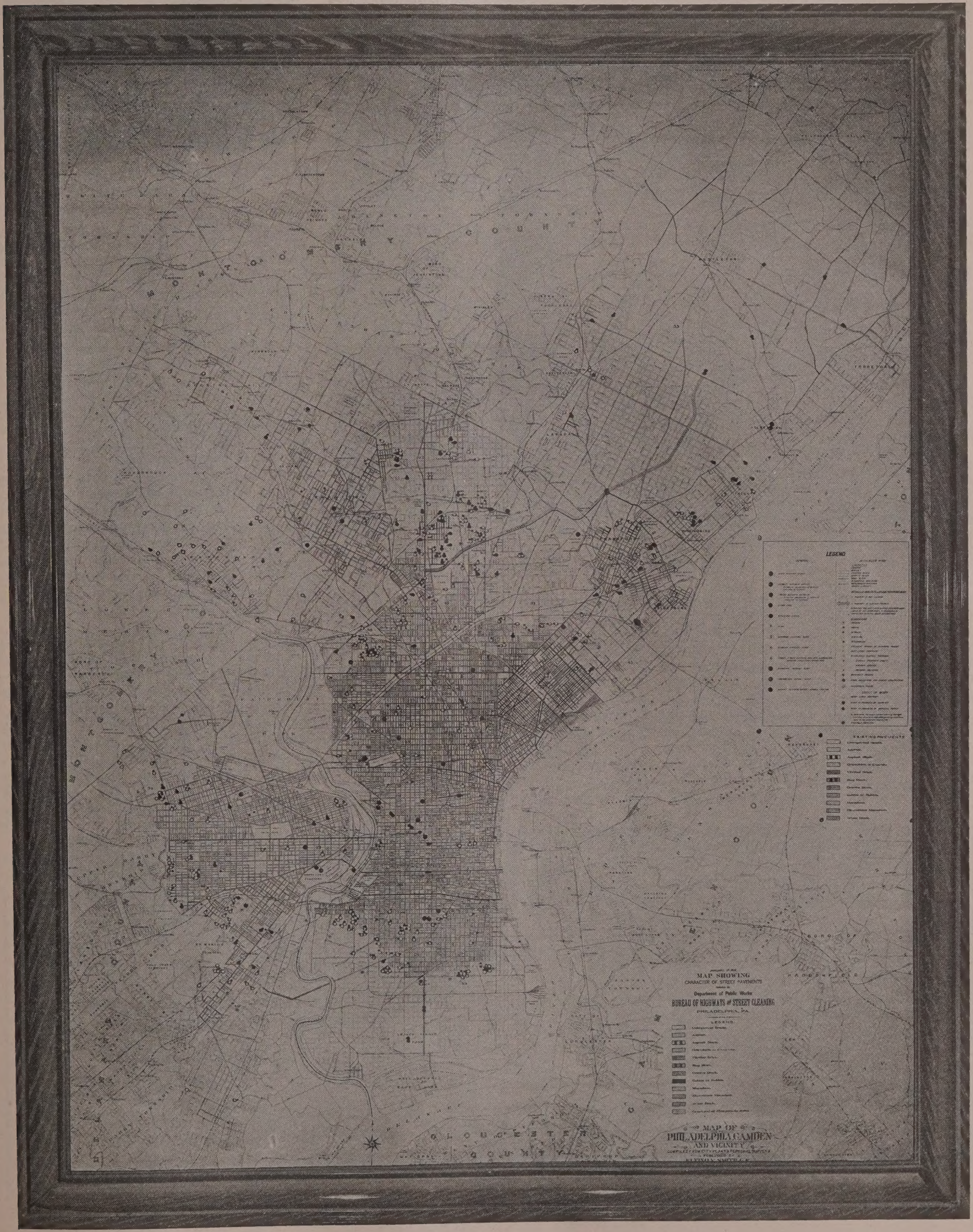
Of course, such information as dates, sums of money spent, etc., cannot be shown on the planning board, but this information is available in a cabinet alongside the map. The cabinet contains a visible card index. The cards, as shown in the accompanying illustrations, are filed alphabetically, by streets, and instead of being in boxes are arranged on vertical metal leaves which can be turned like the pages of a book. The cards indicate the proposed work and work in progress. Samples of the cards are shown herewith. When in position on the vertical leaves the top line of every card in the filing system is visible, and it is a simple matter if, for example, information on Chestnut Street is wanted, to turn to the C's in the index and pick out the card dealing with the section under consideration. This filing device was supplied by the Index Visible Company of New Haven, Conn.

Unbalanced Work

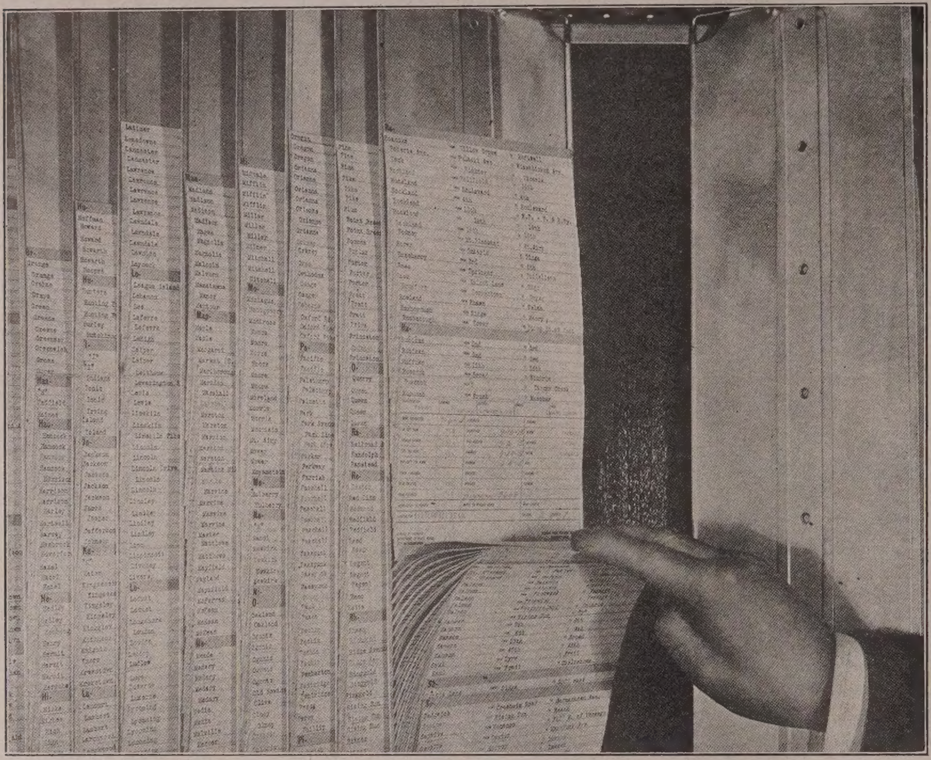
A very important feature of the planning board is its disclosure of what might be

Planning Board Gives Composite Picture of Paving Status in All Sections of Philadelphia by Means of 8 x 10-Foot City Map and Colored Pins

Type of Paving on Every Street Indicated by Colors—Pins of Various Sizes and Colors Show Where Improvements Are Needed and Progress of Work Under Contract—Locations of Pins



termed "unbalanced work"—giving one section of the city more than its fair share of improved streets to the neglect of another. Mr. Connell illustrates this very clearly. "See that bunch of red pins at the center of the map," he savs, "and then notice this mass of white pins near the lower right-hand corner. The red means that work is under way, while the white shows that contracts have been authorized and nothing further done. Manifestly the work is not justly distributed, but this condition is the result of being dependent upon the old method of record-keeping, however thorough it may be, and I didn't realize this state of affairs existed until I started the planning board. It is explained by the fact that a live business men's association is constantly at work for good pavements in the area marked by red pins, while the people in the white area are not organized to look after their own interests so effectively. It is our job here, however, to show no favoritism and from now on the planning board will enable us to serve all sections of town impartially."



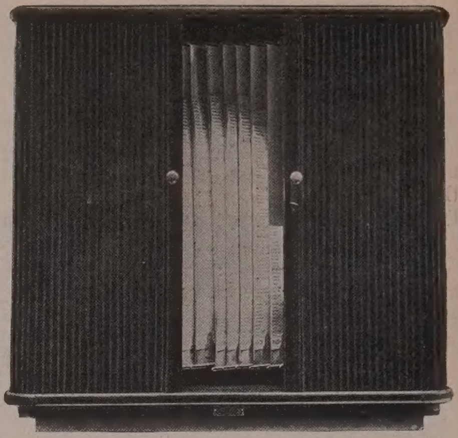
VISIBLE INDEX CARDS ARE CARRIED ON VERTICAL LEAVES AND CONTAIN DETAILED DATA ON PAVING WORK, SUPPLEMENTING INFORMATION SUPPLIED BY PLANNING BOARD

The planning board in the office of the chief engineer is not the only one in use by the Philadelphia Highway Bureau. Each division and district engineer has a similar board differing from the one at headquarters in that they give more detailed information than the chief's board. However, the general principle is the same and the colors and shapes of the marking pins are standardized throughout the department.

Instructions for District Engineers

Here are some of the planning board instructions as to the colors of pins issued to all district engineers:

Large red pin, a definite location in a dangerous condition, requiring immediate attention. Small red pin, a definite location requiring attention as soon as economically possible. Black pin, a definite location where repairs are desirable, but not necessary. Light blue pin, a street or road requiring general, but not extensive, repairs. Dark blue pin, a street or road requiring extensive repairs. Green pin, a street or road requiring repaving or resurfacing. Light green pin, a street or road requiring repaving or resurfacing which has been recommended to be placed under contract (this pin should always be placed beside a dark green pin). Large dark green pin, a street or road which the main office is placing, or has placed, under contract, or on which contract work is being carried on.



VISIBLE INDEX IS CONTAINED IN SMALL CABINET NEAR PLANNING BOARD

The following two additional pins are used in connection with country road work: Lavender pin, a road requiring general attention on shoulders and gutters, but not requiring patching. Amber pin, a road requiring surface treatment.

All locations reported on patrol or police reports or reported by complaint or otherwise are scrutinized and turned over to the man operating the planning board, and the location pinned. When finally repaired it is noted on the records and the pin removed. Streets requiring general or extensive repairs or repaving are handled in the same manner.

Route Sheets Prepared

The man operating the board in each district is the man who is detailed to take general charge of the paving gangs, and it is his daily duty to formulate, from the planning board, route sheets for each gang operating in the district. Great care is exercised in making out these route sheets to see that the locations are as close together as possible and also that they include the greatest possible number of locations where early attention is desirable, or which have been marked with the red pins.

Philadelphia's planning board scheme has been in service since last August, long

FROM			TO		
CLASSIFICATION		MATERIALS			
SCHEDULED					
URGENCY OF WORK					
MATERIALS ESTIMATED					
MATERIALS IN STOCK					
MATERIALS ORDERED					
MATERIALS DELIVERED					
WORK READY TO PROCEED		WORK ORDERED STARTED		WORK STARTED	
				DIVISION	DISTRICT
BUREAU OF HIGHWAYS DEPARTMENT OF PUBLIC WORKS CITY OF PHILADELPHIA				HIGHWAY WORK PROGRESS RECORD MUNICIPAL FORCE WORK	

FROM			TO		
CLASSIFICATION	SURFACE	GUTTERS	TRACKS	BASE	
WORK AUTHORIZED		SCHEDULED		GRADING	
ON CITY PLAN		ADVERTISED		SEWER	
LEGALLY OPENED		BIDS RECEIVED		LATERALS	
CITY TAX RATE		AWARDED		WATER	
NECESSITY FOR WORK		ORDERED		GAS	
FUNDS AVAILABLE		EXECUTED		LIGHTING	
PLAN ORDERED		APPROVED		CURBING	
PLAN RECEIVED					
WORK READY TO PROCEED		NOTICE TO PROCEED ISSUED		WORK STARTED	
CONTRACTOR				DIVISION	DISTRICT
BUREAU OF HIGHWAYS DEPARTMENT OF PUBLIC WORKS CITY OF PHILADELPHIA				HIGHWAY WORK PROGRESS RECORD CONTRACT WORK	

CARDS FOR VISIBLE INDEX FILE GIVE DETAILS OF WORK AUTHORIZED AND UNDER CONTRACT enough to demonstrate that it is an efficient method of handling one of the big problems of large-scale highway department administration. It has not yet reached its ultimate development and minor improvements are constantly suggesting themselves. The board is an outgrowth of a realization on the part of Chief Engineer Connell that the running of a highway department is a business enterprise and, if the work is to be well done, methods of giving the chief executive immediate control over the operations under his direction, such as would be adopted in a big industrial establishment, must be followed in the efficient administration of public work.

New Method Renders Wooden Shingles Fire Retardant

A METHOD for rendering wooden shingles fire retardant has been developed at the Forest Products Laboratory, Madison, Wis., in an experimental way. The method consists essentially in treating the air-dried shingles with a solution of borax in water. The shingles are then kiln dried to about 10 per cent moisture and a second treatment with a zinc-chloride solution is applied. The shingles are again dried and are then ready for use. The solutions must be applied under heavy pressure, and retorts capable of withstanding high pressure are necessary, together with pressure pumps, measuring tanks and other comparatively expensive equipment. Therefore the method cannot be used except where large quantities are being treated.

Theoretically, the process depends upon the formation of an insoluble salt, namely, sodium borate, by the zinc chloride and the borax. This salt is practically insoluble in water, and fuses when highly heated, coating the cell walls and rendering them resistant to fire. It has been found that shingles treated by this method and soaked in running water for two weeks still retain their fire-resistant properties.

The treated shingles when subjected to strong heat will burn, but they will not burn with a flame. They therefore, prevent spreading of fire from one part of the roof to another by falling firebrands.

The process has been developed in an experimental way only, and thus far no shingles treated by this method are being placed on the market.

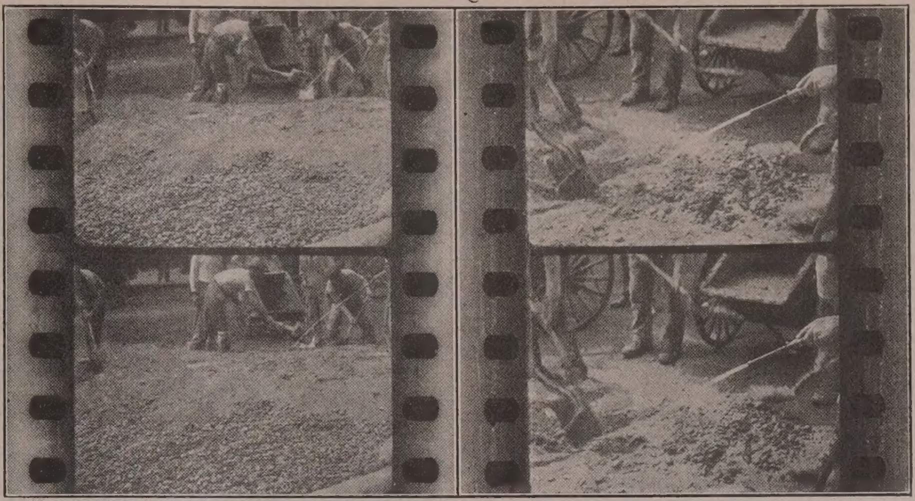


FIG. 6—HAND MIXING—LAYERED MATERIALS IN BED IN LEFT-HAND VIEW—CUTTING DOWN WITH HOSE AND SHOVELS IN RIGHT

Moving Pictures Show Need for Better Practice in Delivering Concrete to Forms

Second of Three Articles on Better Concrete—Abuses Common in the Handling of Sloppy Wet Mixtures

By NATHAN C. JOHNSON
Consulting Concrete Engineer, New York

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*[In the first article of this series, published last week, some considerations were presented in regard to the essentials concretes must possess to be strong and lasting, together with a discussion of the influence that reduced time, brought about by competitive bidding, has had on the mixing of the raw materials which are to form the concrete. An analysis of the operations in a mixer, by means of motion-picture studies, was also made, various undesirable and inefficient actions being pointed out and suggestions made for increased mechanical efficiency as a means of bettering the product, without proportionate increase of cost. In this article a like analysis of hand mixing and of transportation to and placement in the forms will be made, the several operations being considered both from the economic and the quality standpoints.—*EDITOR.]

HAND mixing, as commonly practised, has most of the bad elements of machine mixing, with additional uncertainty as to the incorporation of materials. One method of hand mixing in particular, characteristic of certain construction in New York City, requires only a pile of gravel, a pile of sand and a bag or two of cement, placed near the funneled opening of a vertical chute leading to the forms. Men with shovels throw now one, now another of these materials into the funnel, while a man with a hose runs water on them. Good or bad, sloppy wet or bone dry, all cement or no cement, the concrete goes into the forms, fills them and is paid for. The wonder is not that such concrete is sometimes poor, but rather that it stands up at all. It is to be granted that the mixing cost is low with such methods; not only is it reduced by the brief time required, but there is no overhead cost for machinery. However, it is so haphazard as to result as to

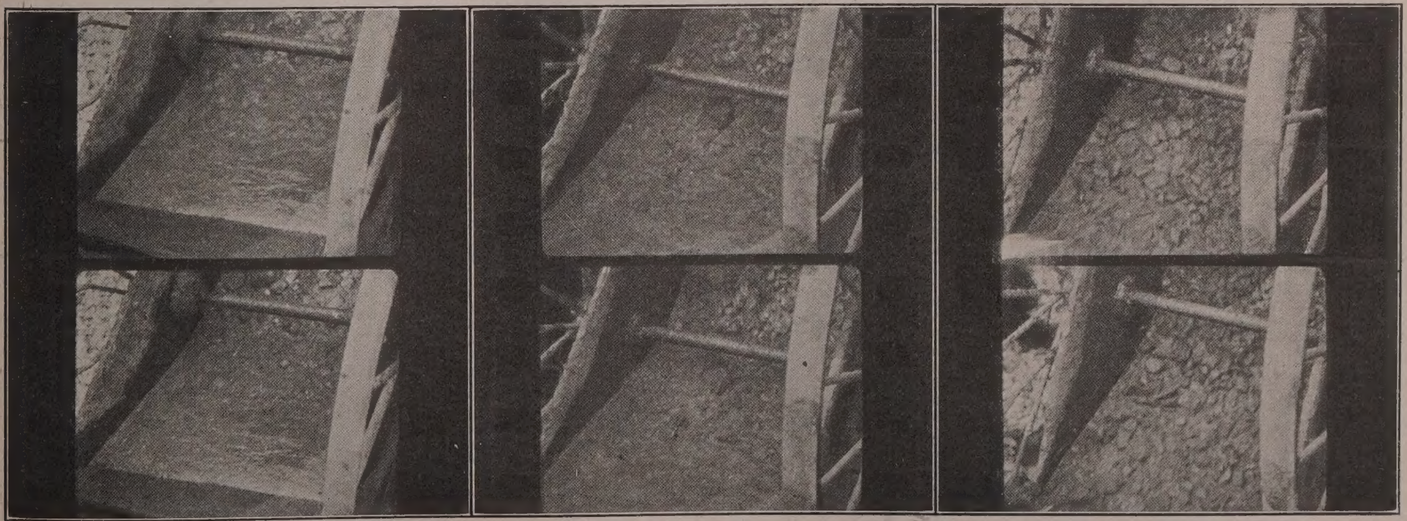


FIG. 7—MOTION PICTURE CAMERA SHOWS HOW MATERIALS SEGREGATE WHILE BEING CARRIED TO FORMS

Left—Liquid on top carries laitance and dirt with it. Center—Lighter sand and some cement come next. Right—Heavy stone and almost no cement or sand last; must ofter be scraped out with shovel.

be beyond the pale of intelligent approval.

In other hand-mixing operations the work is more carefully done. Experimental observation, together with the use of the moving-picture camera, indicates that the best of hand mixing can bring about as thorough an incorporation of materials as does the usual machine mixing, and even better than does such machine mixing as permits the materials to pass through the drum without any adequate interval between charge and discharge.

In one of these better classes of hand-mixing operations it is customary to spread the raw materials in more or less even layers, the final bed being about a foot in thickness, as in Fig. 6, left-hand view. These layered materials are then cut down with shovels, while the hose is played on the mass, as in the right-hand view, Fig. 6. This "mix" is then shoveled directly into concrete barrows and taken to the forms. Viewing the character of results obtained in this way, some portions showing bare aggregate with no cement, and others sloppy wet, but with no stone and an indefinite proportion of sand, what the poorer methods of hand mixing must produce is not hard to conjecture.

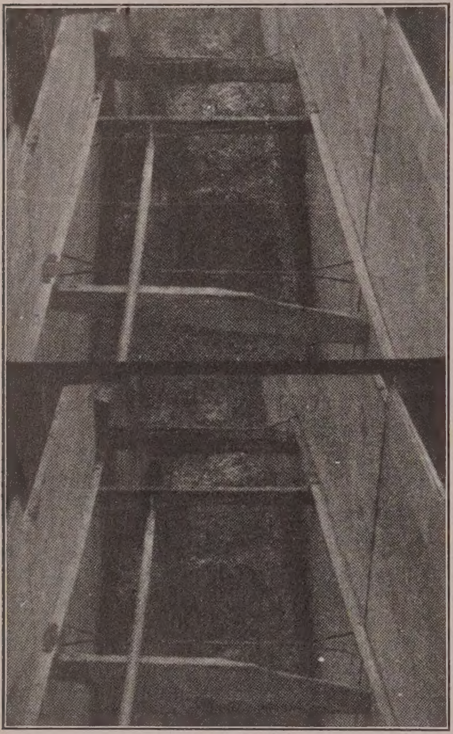


FIG. 8A—CONCRETE SPILLS FROM BARROW INTO FORMS; FIRST THE LIQUID IN A RUSH, THEN HEAVY PORTIONS MORE SLOWLY

DUMPING INTO FORMS

Remembering the almost unavoidable lack of initial incorporation due to such inadequate methods as the foregoing, whether machine mixing or hand mixing; and remembering further the sloppy consistency that is customarily favored, particularly in reinforced-concrete construction, without production of heavy-bodied grout, it is of interest to examine the behavior of concretes after mixing, during the several operations before they reach their final position and solidify.

It becomes of importance, then, to observe closely so simple a process as the dumping of a barrow-load of concrete into the forms, to see if proper relations are maintained. In Fig. 7 is shown in composite photograph this operation as caught by the motion-picture camera. It is noticed that the liquid top goes first into the forms, carrying with it the dirt and scum and light particles called "laitance." A poor bond, these, yet they are going first into the forms, where they will coat the concrete last poured. It is often argued that "averaging," or automatic, even distribution of overlying through lower strata occurs by gravity. Field concretes when sectioned do not, however, attest the correctness of this supposition; nor even if it were correct would it overcome this coating action, particularly if concrete previously deposited has set.

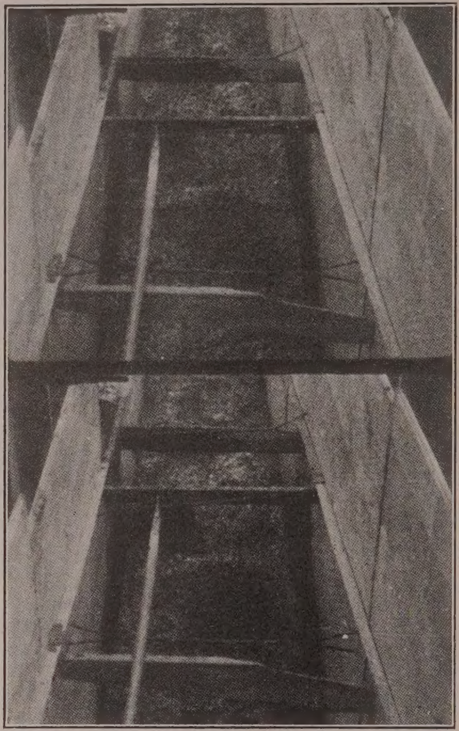


FIG. 8B—DUMPING BEING DONE FROM CONVENIENT RUNWAYS; HEAVY MATERIALS ARE PILED UP AT THESE POINTS

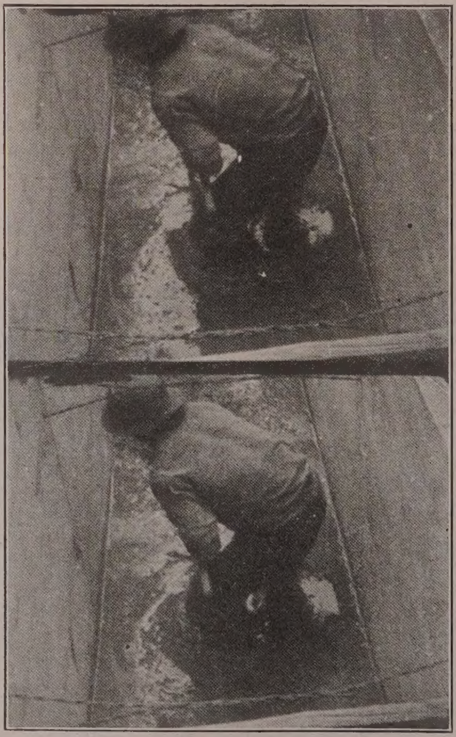


FIG. 8D—DEEP WATER POOLS FORMED

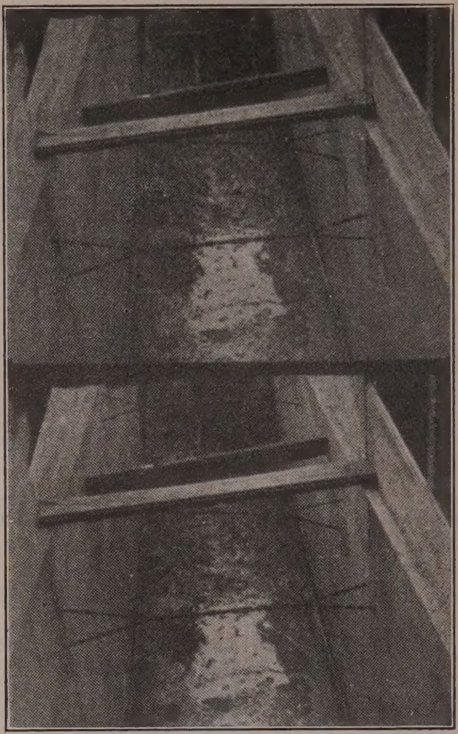


FIG. 8C—WATER AND LIGHTER PORTIONS OF CEMENT, LEAVING STONE NEARLY BARE, HAVE RUN TO LOWEST PARTS OF FORM

After this first rush of dirty fluid, comes the gray of the finer cement and sand, in a sort of soup that constantly thickens with increasing quantities of coarser cement and sand as the pouring goes on. Next comes the heavier sand and finer stone, sometimes washed nearly clean of cement; and at the bottom of the barrow lies the heavier stone, which, refusing to flow, has to be scraped

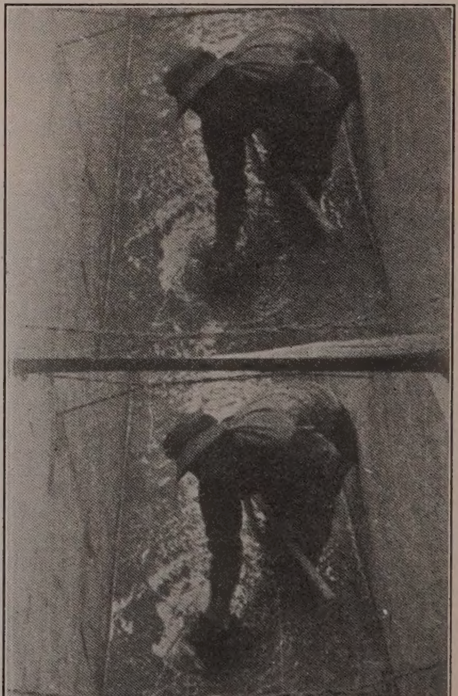


FIG. 8E—POOLS MAY BE SCOOPED UP BY HANDS OF MAN WITH HOE

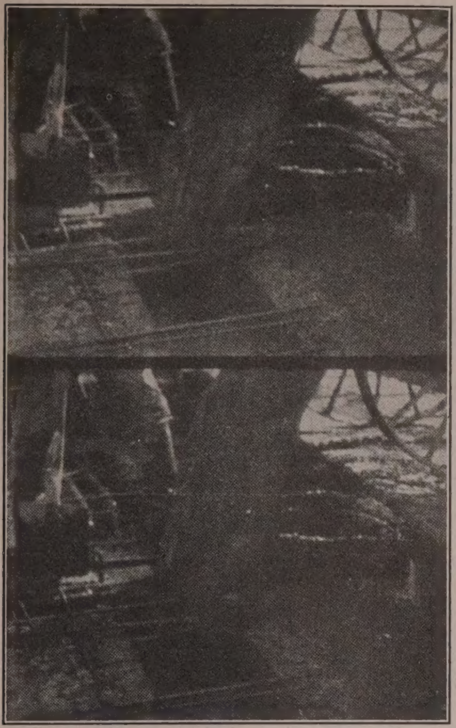


FIG. 9—EXTREMELY WET CONCRETE GOING INTO BEAMS AND ROOF SLABS OF REINFORCED BUILDING

out with shovels. All this is done in a few seconds—not more than a minute after the mixture was delivered by the mixer, for the cost of placing must be kept low—yet the materials have become almost completely separated. A little more time, as in a longer haul to the forms, and this separation, or "segregation" might be complete.

But what of the mass in the forms? How does it lie—in layers, as it went down? What of its endurance? And what of its strength? Is careful design useless? Or is the concrete being used in such bulk, regardless of initial cost or actual possibilities, that nothing would matter, save almost total lack of cement? The answer is that consciously or unconsciously, "Everybody's Doing It," and is "getting away with it"; and if Luck turns thumbs down and if something happens in the far-off Future, there are so many inanimate things that can be blamed when the time comes that the risk is held to be negligible and unworthy of consideration compared to present profits.

If the practices illustrated above occurred only in isolated and infrequent instances they would have little bearing on the general quality and endurance of concretes. Unfortunately, however, they are all too prevalent; and although their impropriety is recognized when pointed out, they are yet of general daily occurrence and will continue so until more general understanding is had of their economic fallacy. When this understanding becomes general, such procedure in the manufacture and placing of concrete will be no more tolerated, by owner, engineer or contractor, than would the distribution of fire-producing chemicals throughout the structure of an inflammable building. Under certain favorable conditions the two might prove equally potent for trouble and damage.

MATERIALS SEGREGATED

The preceding discussion and the photographs of Fig. 7 covered the dumping of the concrete into the forms, viewing that operation from the outside. Fig. 8 shows the concluding phases of this operation, viewed within the forms, as the concrete is received from the barrow and settles into final position. Although the time interval shown in the few pictures of each section of this illustration is very brief, in the first section may yet be seen a marked slackening of the flow from the barrow as the more liquid portions pass off in the first rush, leaving the slow-flowing, heavier particles behind through segregation. The same first rush of liquid and slackening as the solid materials passed over, was observed in the pouring from the barrow in Fig. 7.

But as this delivery to forms continues certain features of the received mass become prominent. It is natural, in order to keep down the placing cost per yard, that as few temporary structures as possible should be built. For this reason one or two runways only per section of form are provided for the barrows; and this necessarily results in a heaping of materials at points adjacent, with less materials at other portions of the forms, which are left as low spots. But since, for economy of time, this concrete has been mixed not more than 22 sec.; since it is sloppy wet, in accordance with tacitly approved procedure; and since it has become segregated, or separated, because the heavy-bodied, sustaining cement grout possible of production with adequate incorporation of cement and water was not produced in the initial mixing, the lighter portions—water, cement and light sand—run off the piled-up portions directly below the barrow runways and into the lower places. But in doing this these valuable and necessary materials leave bare stone piles behind them, while they themselves form knee-deep pools of uncertain composition and questionable final value, which the man hoeing the heavier materials down toward them is perhaps obliging enough to scoop up with his hands, in order to show it as wholly fluid.

But what of the endurance of this concrete? Is it, or can it become, through subsequent "averaging," sufficiently uniform in composition to meet the stresses for which it was designed, unless, as was before pointed out, it has been provided in such bulk, regardless of first cost, that there is really no design operative which is worthy of the name? And, should this concrete be subject to water action, will it be found sufficiently impervious to prevent percolation, solution and disintegration, even though its surface defects be covered, according to custom, by floating after the forms are stripped? And if it should fail, shall the cement be blamed, or the aggregate? Even though it were granted, for the sake of argument, that less than first-grade materials were used, the abuses of making and placing, brought about by the false economy of ruthless speed, are too glaring in this case to make either cement or aggregate the scapegoat.

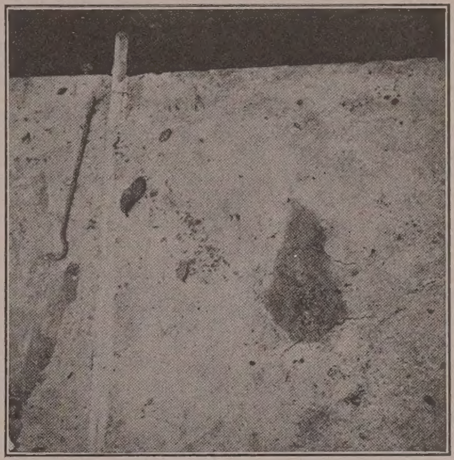


FIG. 10—SHRINKAGE CRACKS CAUSED BY EVAPORATION OF EXCESS WATER

The ultimate loss, however, falls on the

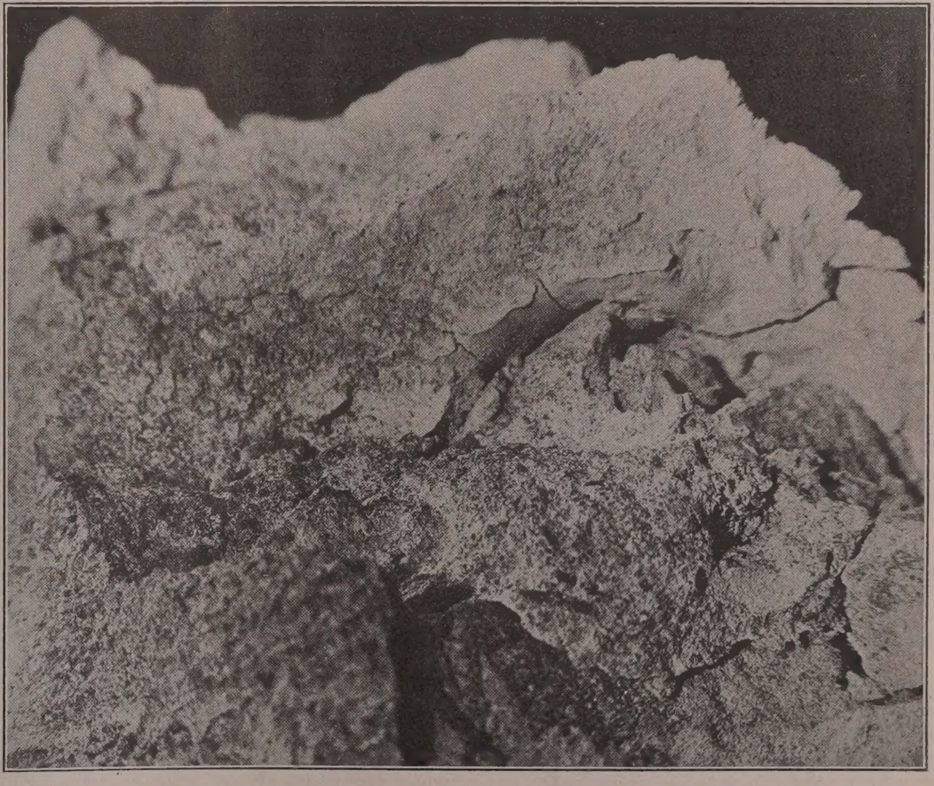


FIG. 11—UNMAGNIFIED PHOTOGRAPH SHOWING WATER VOID WITH MUD OR LAITANCE AND SHRINKAGE CRACKS IN CONCRETE FROM DEFECTIVE STRUCTURE

owner. Cement is a wonderful servant, standing much abuse. Trouble will probably be some time in coming and by then the contractor will be paid and away. Nor has there been any moral obtuseness on the part of the latter. He has done his work probably as well as he knew how, in full accordance with average practice, and as carefully as his bid rate-per-yard has permitted with the making of a reasonable and fair profit.

Obviously, the remedy lies first of all in better understanding of concretes, not on the part of those whose knowledge is beyond question, but on the part of the great army of every-day workers, on whom dependence must so largely rest. If improved methods of mixing can be produced which will secure better results without increased cost the problem is much simplified, but if this cannot be accomplished, there will have to be an economic readjustment all along the line, with the securing of better quality concrete and a proportionate recompense to the owner in the quality and endurance of the structure he has purchased.

Passing mention has been made to the sloppy wetness of the average concrete. The evils of old-fashioned dry concretes, tamped into place, are usually cited in support of the use of sloppy mixtures, as well as the greater convenience of the latter. It is certainly to be granted that very wet concretes are easier to mix and to place than are dry concretes, particularly in reinforced work, where the mixture has to flow into odd corners and maintain close contact with irregular shapes of steel. This applies with special force in building construction, where the various structural members are of small section, as compared with other classes of concrete work. But while the time cost of placing, for sloppy concretes, may be much lower than that of a less fluid concrete, which would require puddling and longer mixing, it is by no means to be conceded that the results obtained with the former are superior to those that more advanced practice produces, or even that their economic features offer sufficient inducement for their continued use in the face of their disadvantages.

EXCESS WATER CAUSES CRACKS

In Fig. 9 is shown an extreme example of such sloppy-wet concrete applied in reinforced building construction. The usual period of mixing was allowed on this concrete, yet even as it was going into the forms, segregation was observable, while over their tops and from their every joint poured streams of water to form lakes on the floor below, while everywhere, over the finished surface, were puddles and pools of water that slowly evaporated in the sun.

But what is to take the place of excess water lost after the time of initial set? Since it occupied space, it must, if lost, leave a void behind. And what of those dissolved products lost with it, which once were part of that cement, purchased at such high cost? And how closely related and knit together are the strong, inert particles of aggregate between which lay the lost water, forcing them apart by its presence in the mass?

The answer is seen on every hand. Shrinkage cracks, such as those appearing within four hours of placing on the surface of this same structure and shown in Fig. 10, together with a myriad others not seen, penetrate the concrete on every hand, cutting down its strength, as any planes of cleavage must. If protected by a moist atmosphere it is true that these may heal through the production of colloid and slow hydration of cement. But in order that form costs per cubic yard may be kept low it is customary to strip forms for re-use as soon as the concrete is at all self-sustaining, so that rapid drying in the air in a large measure precludes this possibility. Concrete may be "good enough as it is," yet there are few who would not rejoice to see it bettered.

But lest the thought occur that these statements are hypercritical, in Fig. 11 is shown, full size, a fractured concrete, taken at random from a massive structure. It will be observed that here the water space is of very appreciable size and that radiating from the main fissure are smaller fissures and pores of indefinite direction and depth. Certainly these pores and fissures, whether full of water or air, possess no structural strength. Since like fissures are prevalent in concretes the conclusion is inescapable, because structures of concrete stand up and are useful, that general practice must be to use concrete in enormous bulk at low stresses, without regard to first cost or secondary losses due to restricted useful space, in order that those objectionable practices which have become habit may be followed undisturbed. It is not exaggeration to say from what is indisputably known as to the possibilities of concrete that once there is secured a general appreciation of the unfortunate results of improper procedure, and particularly if more efficient apparatus is devised by which better procedure will be made economically possible, that present products and practices will be looked back to as belonging to the dark ages of concrete. It is the history of every industry; and the many able investigators throughout the world engaged on concrete research are bringing the time of realization close to hand.

In further connection with the use of sloppy concretes for the saving of money, an amusing phase of the situation may not be unappreciated. Each bucket of excess water in concrete takes as much space as half a bag of cement. Two buckets could replace a whole bag of cement on a basis of volumes. True, eight extra buckets of water per yard would change 1:2:4 concrete into 1:2½:6 concrete or worse, but the mixture will probably stick together pretty well and no guarantees of endurance are asked or given. And think of the total saving! Holding out a sack or two of cement per batch is rarely or never thought of nowadays by anyone. The gentler and albeit unconscious method of achieving the same end, approved by nearly everyone, is to *add water*.

[*The next article, which will appear in an early issue, will take up other phases of the problem of concrete manufacture as shown by motion-picture studies. Particular reference will be made to the spouting of concrete and its uses in special classes of construction, together with further studies of the effect of excess water on the quality of concrete.*—EDITOR.]

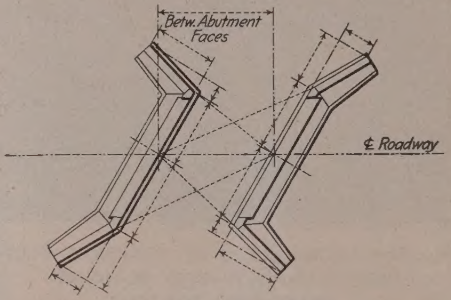
PRICES OF THE MATERIALS that go to the making of dynamite rose from 18 to 585 per cent between July, 1914, and August, 1915, according to figures compiled by the *DuPont Magazine*. The price of sulphuric acid has risen 476 per cent to $75 per ton, while the price of saltpeter has risen 240 per cent and that of glycerin 33 per cent.

Skew Abutments Laid Out Without a Transit

Wisconsin Highway Commission Uses Standard Plans—Sides of Triangles Computed to Locate Determining Points

IN MANY PARTS of Wisconsin the highways follow section lines closely, and since the streams do not always flow toward any of the four cardinal points of the compass, it is often necessary to build skewed bridges. In the cases of trusses this complicates the shop work slightly, but I-beam or plate-girder steel bridges can be built on a skew without increasing the shop work materially.

It is not usually possible to have a transit on the ground to lay out the skews and so in the early designs of the Wisconsin Highway Commission it was customary to show skews by means of offsets from lines at right angles to the center line. This method, however, gave great opportunity for error and a simple and more accurate method has recently been devised, utilizing instead dimensions for three sides of a triangle.



MEASUREMENTS USED IN LAYING OUT A SKEW WITHOUT A TRANSIT

The location diagram shown herewith gives the distance along the center line between neat work of the two abutments, and these points are staked in the field. The distances from these points to the points where the wings turn back are computed, and these points may then be laid out by two measurements. The direction of the wings is given by right angle offsets from a continuation of the line of the face.

The idea previously explained in the Engineering Record of Dec. 4, page 688, has been utilized in the preparation of standard designs for skewed abutments for I-beam bridges. Typical drawings have been prepared, one for the case where the skew is right-hand forward and the other for the reverse, and the zinc etchings and printed copies made. These are used as previously explained except that no effort has been made to standardize dimensions nor calculate quantities in advance.

FORTY MILES OF CONCRETE ROAD have been laid this year in Milwaukee County, Wisconsin, outside of the city limits of Milwaukee. H. J. Kuelling, county highway commissioner, states that this now gives nine different routes complete to the county limits. Last year 33 miles of concrete road were built. The percentages of the various types of the 100 miles of improved roads in the county are as follows: Concrete, 86 per cent; sheet asphalt, 7 per cent; brick and sandstone block, 2 per cent; tar macadam, 2 per cent; waterbound macadam, 3 per cent. Plans for 1916 and 1917 include a 40-mile loop around the city of Milwaukee connecting the radial routes.

Keep the Wheels Turning to Make Motor Trucks Profitable for Contractors

Hire Best Drivers, Keep Trucks in Good Repair and Provide for Quick Loading and Discharging, Says Manager of Motor Haulage Company

TO KEEP the wheels turning is the secret of making the motor truck pay on contract work, in the opinion of Clinton Bretell and R. H. Matthiessen. These men, under the name of Motor Haulage Company, have been doing a paying business for some time in hauling materials for road contractors and others in the vicinity of New York City. According to them, if teams are to be replaced by motor trucks with economy several conditions must be met. The trucks bought must not only be good, but must be kept in first-class repair. Only first-class men should be put in charge of motor trucks. The hauling should be done over roads the greater part of which are good enough for a speed of at least 6 miles an hour, and roads which permit a speed of 8 or 9 miles an hour make the use of motor trucks much more profitable. Mechanical loading and rapid dumping are almost necessities if motor trucks are to show a profit over horses.

KEEP TRUCKS IN GOOD REPAIR

The waiting time of a team and wagon seldom amounts to more than 50 cents an hour. The waiting time of a 6-ton auto truck is seldom less than $2 an hour. For this reason, even discounting the additional delay to the contractor's forces from having a larger unit put out of service, a motor truck soon eats up all the profit it has made if it is allowed to get in a condition where breakdowns are frequent. The loss due to a day's delay, when there is work waiting for the truck, will offset the price of new drive chains, and the man who fails to buy new parts when they are needed soon pays more than their value in time lost from having his trucks laid up. Like all other machines, when one part of a motor truck is kept in service after it is badly worn, other parts begin to wear more rapidly than they should, and general breakdown soon results.

One hundred thousand miles is not too much to expect of a well-cared-for motor truck before upkeep becomes so high that it pays to buy a new truck. A good truck, properly used, however, should pay for itself in four years and still show a very fair profit. This length of time should be used in figuring depreciation. Seven thousand miles may be expected of a good set of rear tires when hauling only on paved streets, but for hauling road materials, where a large mileage is made over rough going, 5000 or 6000 miles is all that can be asked. Front tires should give considerably higher mileage. Drive chains will last 7000 miles before they stretch so as to wear the sprockets unevenly, and to cause frequent broken links. When this happens they should be replaced at once. Old chains need not be scrapped, but may be taken apart and the little-worn pieces used in repairing other chains.

DRIVER IS IMPORTANT FACTOR

When a frame breaks, or a car is wrecked, it must be taken to the shop. Nearly all other repairs, however, can and should be quickly made in the field by the driver. Spare parts, even to extra springs, are kept on hand by the Motor Haulage Company and distributed to the different trucks as needed in a light runabout. The drivers and Mr. Bretell himself watch all the trucks closely. At the first sign that a new part will be needed, that part is bought and kept on hand. When the old part wears so as to attract attention in running, or even before that, it is at once replaced. These men have found that it does not pay to use parts until they are entirely worn out or break. The delays to operation and the strain and wear on other parts make such a course very expensive in the long run.

GOOD DRIVERS A NECESSITY

The best drivers to be had are considered a good investment by Mr. Bretell, and should be for any contractor. These men not only know their trucks thoroughly and how to drive under all sorts of road and traffic conditions, but they also know something about the work of the contract on which they are employed. A stupid driver, who has not a rough general knowledge of how contract jobs are worked, nor how to handle his truck so as to keep that end of the job going, can cost a contractor a great deal of money. As with all other classes of labor, generous dealing with good drivers has been found to pay well. Men employed by the Motor Haulage Company frequently work at odd times and on Sundays to keep their trucks in shape. It is made worth their while to do this, and they do it gladly. The result is contented employees and greater efficiency.

ROADS A BIG FACTOR

To compete with the horse, motor trucks should make at least twice his speed. This means that in going where a greater speed than 4 miles per hour is impossible for any vehicle, the horse will have the advantage. However, such places are becoming rare, and only include the worst conditions under which hauling can be done at all. A short stretch of haul over subgrade on a road job, even where a culvert or so has not been placed, does not make hauling with

SHORT STRETCHES OF THIS SORT OF ROAD DO NOT BOTHER MODERN MOTOR TRUCK

QUICK DUMPING ON ROAD WORK

motor trucks unprofitable. It also takes a succession of extremely steep and bad hills to put the modern motor truck out of the race.

Short hauls are less profitable, because of the multiplied waiting time in loading and unloading. Where first-class facilities requiring stops of little more than a minute at each end are at hand, round-trip hauls of little more than a mile have been made profitable. Loading with chutes from an overhead bin, with a grab bucket, or with a steam shovel, are most necessary, and holding a large-capacity truck an hour or so on each trip to load it by hand soon eats up all the saving it can make. Unloading should be done by dumping the material in a pile, or by spreading it on the return trip. This last was done recently with economy in building a macadam road near Little Ferry, N. J., where trap rock was spread. In this instance the trucks of the Motor Haulage Company not only replaced poorer transportation, but eliminated a large crew formerly employed in spreading the stone by hand. In spreading stone for concrete road work each truck load is dumped separately at proper distances along the subgrade.

QUICK LOADING IS ESSENTIAL

It is seldom economical to drive motor trucks up on a high pile of material. They can, however, be handled with success on dumps unless a great deal of sticky material has to be hauled in wet weather.

TYPE OF TRUCK MUST SUIT THE WORK

For general hauling of road materials this company has had great success with 6-ton units of medium weight and strength. Locomobile and Pierce-Arrow trucks have been used, holding from 4 to 5 cu. yd. of stone or sand. If a very rugged truck is bought for use under severe conditions, its owner must remember that it will cost more to operate under good conditions than a less heavily built unit. The stronger truck has more dead weight to pull around, and, having a larger motor, is not so economical of gasoline. The trucks used by the Motor Haulage Company are all power-dumping with back-tilting bodies, and have high removable sides for hauling coal, ashes and light material.

TWO TRUCKS REPLACE TEN TEAMS

On a State-road contract near Ridgefield, Conn., from twelve to fifteen teams were employed last summer with such bad results that hauling costs were eating up the profits of the job. There were such a large number of units on the long haul that it was hard to keep track of them, and much time was wasted by the drivers. The Motor Haulage Company persuaded the contractor to replace five of these teams with one truck, with the result that two trucks were soon on the job and practically all the teams had been dispensed with, only a few being kept for very short hauls. Conditions were fairly good for motor-truck service, material was always there when the contractor needed it, the truck drivers were reliable and on hand when wanted, and the job soon began to show a profit.

The foregoing is only one instance of what the contractor may do with motor trucks. Even the hauling of large girders and structural steel for buildings has been a view to the class of work required, and facilities are to be had. The experience of the Motor Haulage Company seems to show that motor trucks, when bought with a view to the class of work required, and run with ordinary good judgment, will make money for contractors in a wide range of operations.

Belt Line Is Proposed as Solution of Dallas Grade-Crossing Problem

By Intercepting Through Business John F. Wallace Thinks Railroad Lines in Heart of City Could Ultimately Be Removed and Replaced by Streets

A BELT LINE that would intercept all of the railroads that now run through or into the heart of the city of Dallas, Tex., and carry all of their traffic, except perhaps that of local industries, around the business district, rather than the elimination or protection of the existing grade crossings, is the solution of the whole Dallas problem offered by John F. Wallace, consulting engineer, of Chicago and New York, in an extensive report submitted Nov. 22 to the mayor and commissioners of that city. He estimates that to eliminate all of the existing crossings, except such as could reasonably be closed, would cost about $5,000,000. In general it would be necessary to elevate the tracks, depressing the streets only to a limited extent; some of the railroads occupy city streets and would have to be carried on steel elevated structures. To protect all of the existing grade crossings by watchmen, gates and bells, and capitalize their maintenance, would cost about $3,200,000. On the other hand, by utilizing existing lines in part, and closing the gap by new construction, a belt line without grade crossings could be provided for about $900,000. For the time being the existing tracks could be allowed to remain to serve the existing industries, with restrictions as to speed and hours for operation. New industries would be obliged to locate in assigned districts, however, and ultimately Mr. Wallace would have the existing tracks within the loop removed and the rights-of-way taken over by the city and converted into broad through streets, of which the city is greatly in need.

Following is an abstract of Mr. Wallace's report. The table is a condensation of voluminous data presented by Mr. Wallace and does not appear in this form in the report. Space limitations also preclude reproduction of more than bare outlines of some of Mr. Wallace's drawings.

THE PRESENT NETWORK

Dallas, like most American cities, has grown up without any well-defined plan. Topographically the location of the city was accessible from almost any direction. Railroads were welcomed as assisting in the development of the city, and the rights-of-way were sought and secured along the lines of least resistance. The result is shown in Fig. 1, in which it is seen that the railroad lines intersect the city in various directions, and that there are in addition various spurs and connections.

The Texas & Pacific Railway was the first to enter the city, and its location to a large degree fixed the main retail business district, which is restricted to about three streets extending east and west, parallel to this railway. The wholesale district extends along the western end of the Texas & Pacific and somewhat north and south of this line. The population of the city has increased from 10,000 in 1880 to 110,000 or more in 1915, and high-class residential districts have developed in almost all sections of the city. Some of these are separated only by the inferior districts along the railroads.

THE INDIVIDUAL ROADS

The Texas & Pacific crosses the city in an easterly and westerly direction. For 6000 ft. east from the Trinity River it occupies Pacific Avenue, along which are the freight houses and numerous industries. The main yard is just east of the Houston & Texas Central crossing. The Houston & Texas Central crosses the city in a northerly and southerly line about ¾ mile east of the geographical center, and reaches into the heart of the city by the Marilla Street Branch, at the end of which are its freight terminals. The main yard is at the junction. The Texas & New Orleans originally extended southeasterly from the Texas & Pacific, but since the construction some years ago of the Warren Avenue connection to the Houston & Texas Central the use of the old line has been mostly confined to the service of the industries along it. The road has no local freight house.

The Gulf, Colorado & Santa Fé is situated similarly to the Houston & Texas Central, crossing the city outside of the business center and reaching its local freight terminals in the heart of the city by a spur. Its main yard is between the Houston & Texas Central and the Texas & New Orleans. The Missouri, Kansas & Texas follows Turtle Creek and the Trinity River. Its main yard and local facilities are just north of the Texas & Pacific. The St. Louis Southwestern is also along the river front. It owns the Dallas Terminal Railway & Union Depot Company, which is building the union station. [See the Engineering Record of Aug. 22, 1914, page 212.] In the southerly part of the city a line of the terminal company intercepts the Gulf, Colorado & Santa Fé, the Houston & Texas Central and the Texas & New Orleans, and reaches the Texas & Pacific. The St. Louis Southwestern has local freight terminals east of the Union Station. The Chicago, Rock Island & Gulf has no grade crossings in the city, and no terminal facilities of its own.

Data concerning the mileages within the city limits are given in the first columns of the accompanying table.

After a careful study of the profiles of the various railroads in the city and the topography of the adjacent territory, the conclusion was reached that the elimination of the grade crossings on their present locations could best be brought about by the elevation of the tracks and the depression to a limited extent of the intersecting streets, except in a few individual cases where it would be desirable to carry the streets over the railroads. As a preliminary a careful study was made of the street system with a view of determining which streets would be most desirable to be provided with undercrossings, having in mind the best circulation of traffic between the different parts of the city, and a map was prepared [not shown in this abstract], showing the location of the subways.

The same standards of construction were

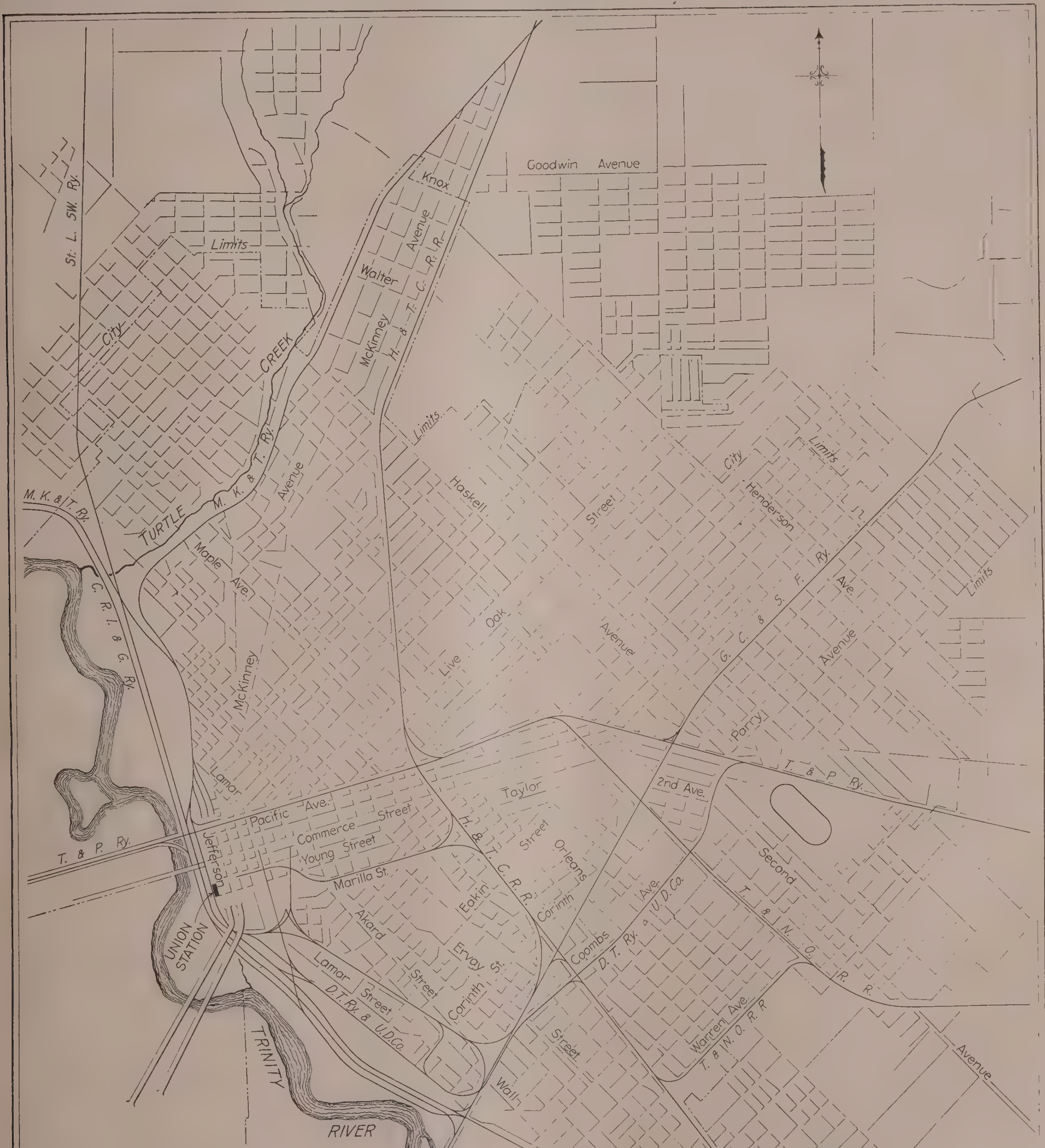


FIG. 1—THERE ARE ABOUT 160 GRADE CROSSINGS IN THE EXISTING NETWORK OF THE EIGHT RAILROADS

uniformly used. As all of the railroads with few exceptions penetrate a good class of residential territory, it was thought desirable to adopt a standard subway design that would offer a pleasing appearance without going into excessive cost. The type chosen is of the unit reinforced-concrete type, with underclearances of 13½ ft. and floor depths of 3½ ft., making the base of rail 17 ft. above the street surface. Simple architectural ornamentation is applied to the concrete.

The standard for steel viaducts in the streets consists of bents from 35 to 50 ft. apart, the two columns being 40 ft. on centers. Where there are only two tracks these are carried on girders connecting the columns. By means of cantilevered extensions of these girders industrial tracks can be carried, with room for platforms between them and the main tracks.

A paneled design of retaining wall with plumb face and no coping was adopted to hold the embankments where the right-of-way is insufficient for natural slopes.

Mileages, Existing Grade Crossings and Estimated Cost to the Individual Railroads of Eliminating Them

Railroad	Mileage in City: Main line	Mileage in City: Total trackage	Existing grade crossings	Proposed separated crossings: Total	Proposed separated crossings: Subways	Proposed separated crossings: Open steel	Proposed separated crossings: Street viaducts	§Estimated cost
Texas & Pacific	3.70	11.80	25	23	9	14	..	$1,250,000
Houston & Texas Central	†6.74	13.81	53	49	29	18	2	1,655,000
Texas & New Orleans	2.85	3.88	12	17	17	..	..	443,000
Gulf, Colorado & Santa Fé	‡5.98	17.82	17	21	21	..	..	800,000
Missouri, Kansas & Texas	7.65	20.07	11	14	12	..	2	¶220,000
*St. Louis Southwestern	5.10	9.80	23	8	6	1	1	307,000
Chicago, Rock Island & Gulf	3.50	....	0	..	..	..	..	....
Total	35.52	77.18	141	132	94	33	5	**$4,675,000

*Including Dallas Terminal Railway & Union Depot Company.

†Includes Marilla Street Branch, 1.32 miles long, leading to freight terminal.

‡Includes down-town branch, 2.10 miles long, leading to freight terminal.

§In case fewer or more subways are to be provided than are shown on the plans, $9,000 for single track and $12,000 for double track should be deducted or added for each subway.

¶$394,000 for double track.

**To this should be added $110,000 for changes to industries, mainly those along the Texas & Pacific.

Some of the Individual Problems

The accompanying table gives the estimated cost of eliminating the grade crossings on each of the individual railroads, together with a summary of the number and kind of structures involved. Some of the individual difficulties are as follows:

Texas & Pacific.—It is proposed to carry the 6000 ft. along Pacific Avenue on a steel viaduct. Along this structure numerous industries with side tracks are provided for. In order to avoid cutting off several of the streets along the river it was thought necessary to carry the track elevation across the river. The plan is developed with the idea of carrying the tracks on the top chord of the existing bridge with a slight rearrangement of the structural details. The connection with the Union Station would be from the west on the lower grade, and it is proposed that the industrial facilities of the Texas & Pacific Railway between the Union Station tracks and Lamar Street be continued at the present level, access to them being through the north throat of the Union Station tracks. The existing freight house would be rearranged to fit the elevated tracks.

Houston & Texas Central.—The special difficulties encountered by this railroad are at and south of the Texas & Pacific crossing. Over this crossing, from Commerce to Live Oak Street, because of the narrow right-of-way and the question of damages, an elevated structure was figured. From Commerce south to Eakin Street is the main yard of this road, and it is proposed to maintain this on its present grade, with some of the tracks stub-ended on the north. Eakin and Taylor Streets, the only ones carried across, would be carried on viaducts. Most of the Marilla Street Branch would be carried on an elevated structure. The existing freight house would have to be adjusted to the new level.

Texas & New Orleans.—The old line to the Texas & Pacific might be retained at grade and operated under restrictions. The estimates, however, provide for its elevation.

Gulf, Colorado & Santa Fé.—A 1-per cent grade beginning at the east bank of the Trinity River would bring this line high enough to cross over the Missouri, Kansas & Texas, and at Wall Street the tracks of the Dallas Terminal Railway & Union Depot Company would be crossed at grade. The existing yard between Orleans Street and the Texas & New Orleans would have to be elevated to the same plane as the main-line elevation, but the engine terminal could be left on the existing level and reached from the elevated line with a rather steep descending grade.

Missouri, Kansas & Texas.—From the south city line to the north line of the yard north of the Texas & Pacific crossing no changes are proposed except those involved in the construction of the Union Station. Up Turtle Creek the line is on broken side-hill and lends itself to the construction of the necessary subways with very little change in the track profile until the line leaves the creek, near Walter Street. Considerable study was given to this section of the line, which would be part of the belt line proposed. In the scheme adopted a number of the streets are straightened, and it is believed that adequate intercommunication is provided between the sections of the city east and west of the line for all time to come.

From Walter Street north it is proposed to depress the tracks and carry them under Knox Street, the total depression at this

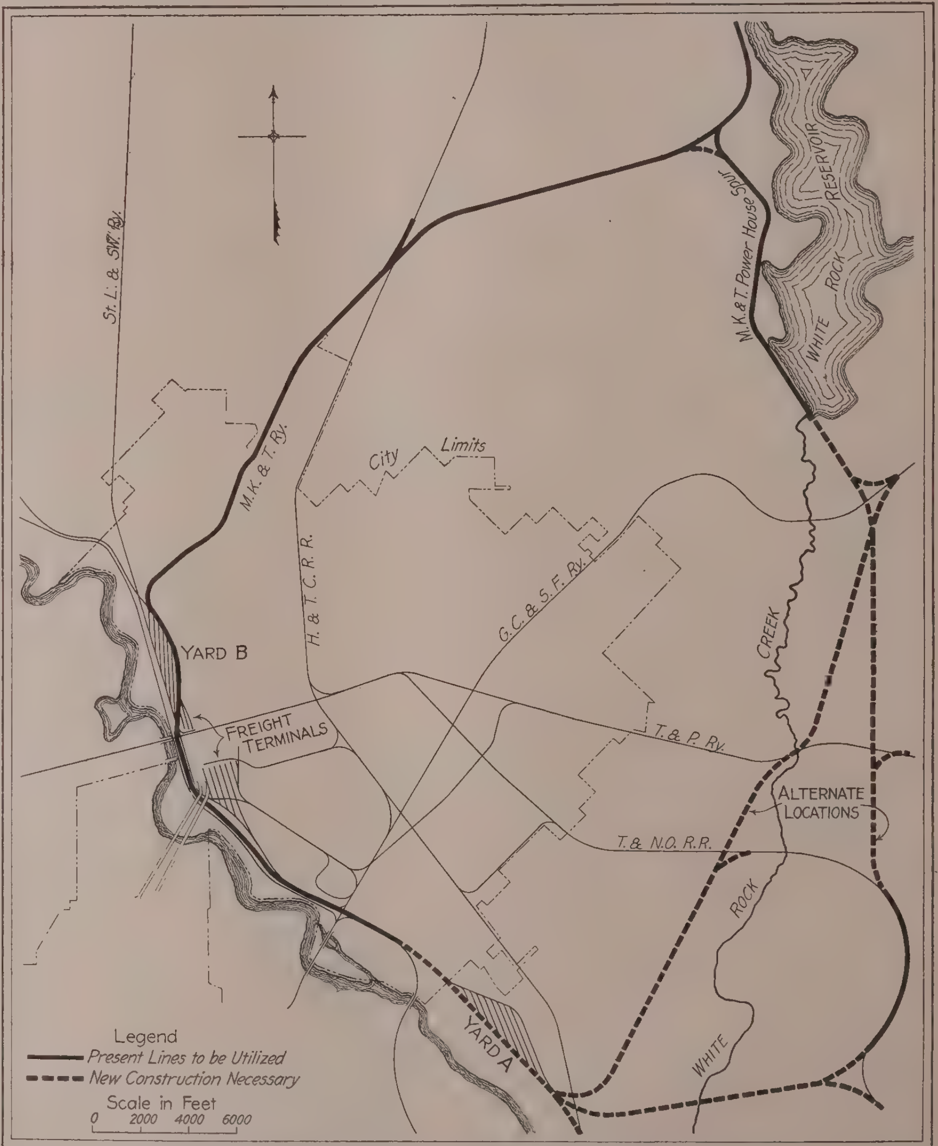


FIG. 2—COMPARATIVELY LITTLE NEW CONSTRUCTION IS NEEDED TO FORM A COMPLETE BELT LINE INCLOSING MOST OF THE CITY

point being 13 ft. The line would come to grade a short distance south of the Houston & Texas Central crossing.

St. Louis Southwestern.—South to Corinth Street no changes are contemplated in this line or that of the terminal company other than those required incident to the construction of the Union Station. From this street an ascending grade will bring the road to a crossing with the Gulf, Colorado & Santa Fé, and from there north to Ervay Street the two roads would be parallel and on the same plane. From Ervay Street north to the Houston & Texas Central the line occupies Coombs Avenue, and would have to be carried on a viaduct. Beyond the Houston & Texas Central the line would cross two streets and then come down to grade, passing under the Texas & New Orleans and the Texas & Pacific Railways. Operation over this part of the line would be restricted to the night hours.

$3,200,000 TO PROTECT PRESENT CROSSINGS

There are at present within the city limits about 160 grade crossings. The cost of installing a set of crossing gates with bells is estimated at approximately $400, and if the gates were installed at all of the existing crossings they would require an expenditure of $64,000. The wages of operators for these gates, together with the necessary repairs, would represent an expenditure per annum for each crossing of about $1,000, or $160,000 in all, which, capitalized at 5 per cent, would represent $3,200,000. The capitalized effect of installing gates and bells at all crossings would therefore be $3,264,000. In practice it might be found that some of the crossings included in this total would not require gates, and in some other instances it would be necessary to station operators only at certain hours in the day. These modifying conditions would reduce the total shown above.

CONDITIONS IDEAL FOR BELT LINE

The topography of the city and the location of the routes of entrance of the various railroads present an almost ideal condition for the construction of a belt line for the joint use of all of the railroads for their through passenger and freight business and for access to their present local freight facilities, which could continue to be operated by the individual roads in their present locations without fear of interference with the development of the city.

It is believed that the construction of such a belt line and the ultimate removal of tracks within this loop would be for the best interests of both the city and the railroads. For the city it would remove obstacles to harmonious development and make possible an improvement in the city plan, which would be very desirable. For the railroads the construction and operation of this belt line would solve the grade-crossing problem at but a fraction of the expense of track elevation, and would for all time solve the problem of railroad and industrial development in the city.

Fig. 2 shows a suggested arrangement for this belt line. It is proposed to use the existing lines, improved, from the crossing of the Houston & Texas Central with the Missouri, Kansas & Texas on the north to the point at the south end of the city where the latter railway turns to cross the Trinity River, passing around the Union Station. Two alternative locations are shown for new construction to the Gulf, Colorado & Santa Fé, the last of the lines running eastward. Suitable wyes would be constructed to each of the lines intercepted. The loop could be closed by a short extension to the power-house spur of the Missouri, Kansas & Texas.

Two general freight yards, A and B, are suggested. At these sites there is sufficient area available for the development of facilities equal to double the capacity of all of the individual terminal yards of all of the railroads entering the city. It may develop on further study that it would be more desirable for each of the railroads to build its own facilities along the belt line. In this event the best arrangement would probably be for them to use the same location indicated for the two general freight yards. The precise location of the part of the belt line to be constructed could also best be worked out by the railroads themselves.

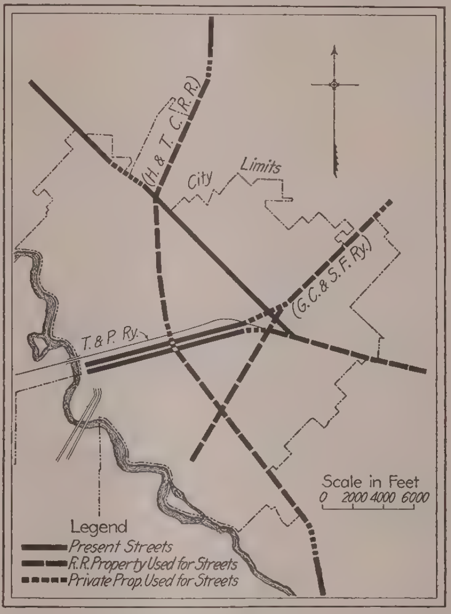


FIG. 3—SUGGESTED USE OF SOME OF THE ABANDONED RIGHTS-OF-WAY

In order to avoid the crossing of the south throat of the union-station layout at grade to reach the local freight facilities along Young Street, it is entirely feasible to separate the grades of the freight and passenger tracks at this point by carrying the freight tracks under. By removing the Marilla Street Branch these local freight facilities could be rearranged to good advantage.

The functions of the present terminal company might be extended to provide for the construction of this belt line and the taking over of the necessary trackage rights, or a new terminal company might be organized for this purpose, this terminal company in turn to lease trackage rights to the various railroads or perform a switching and terminal service for them.

USE PRESENT RIGHTS-OF-WAY FOR STREETS

With a belt line provided the question as to the disposition of the tracks of the individual railroads inside the city limits remains to be disposed of. The ultimate solution would be the entire removal of all tracks within the city limits other than those necessary in reaching the local freight facilities and the industries adjacent thereto. This would leave the territory between the Trinity River and Akard Street extending from the Gulf, Colorado & Santa Fé on the south to Young Street on the north, as well as the territory along the river in the vicinity of the two yards A and B, to be developed for local freight and industrial purposes. Nevertheless, in Dallas, as in almost any city, the railroad situation is intimately related with the development of the street plan. The presence of the railroad has in a measure controlled the nature of the development, but this has only extended for a short distance on either side of the railroad, and in all sections of the city there are areas of good residential property separated only by the lower-class developments adjacent to the railroads. The removal of these roads would ultimately result in these various better-class residential districts expanding to a unified whole.

THROUGH STREETS NEEDED

The city is suffering from a lack of through streets extending from one end of the city to the other. The removal of the railroad tracks as suggested presents great opportunity for the taking over of these rights-of-way as continuous streets and the widening and development of them. The possibilities in this direction are indicated in Fig. 3. With the connecting links shown there might be developed thoroughfares to all sections of the city, these forming a natural central axis in the vicinity of Commerce Street and the present line of the Houston & Texas Central. The possibilities are presented of developing a splendid municipal park and civic center, extending from the present line of the Houston & Texas Central to the present location of the City Hall.

The attempt to bring this about immediately would probably not be found desirable. For the present it might be preferable to have an arrangement made between the railroads and the city which would restrict future industrial development to the part of the city naturally segregated for industrial development, and the gradual removal of the existing facilities to this district, permitting in the meantime switching to and from the existing industries over the existing tracks during the night hours, under such precautions as to speed and flagmen as would protect the street traffic of the city.

THE TOTAL WORK OF THE U. S. RECLAMATION SERVICE, completed up to the beginning of the present fiscal year, according to a summation prepared by the service, includes 9592 miles of canals and ditches, the excavation of eighty-nine tunnels with an aggregate length of more than 25 miles, the building of 4622 bridges with a total length of 19 miles, the construction of 82 miles of railroad and the erection of 1068 buildings, such as power houses, pumping stations, offices, residences and store houses. Dams of masonry, earth crib and rock fill have been constructed with a total volume of 12,200,000 cu. yd. The available reservoir capacity at the time of the summation was approximately 6,500,000 acre-ft., or sufficient to cover the States of New Jersey and Delaware to a depth of 12 in. Culverts built number 5714 and total 36 miles in length. There are now in operation 298 miles of pipe line and 85 miles of flumes. Wagon roads have been built to an aggregate length of 784 miles, many of them in what were inaccessible mountain regions.

Test Truck and Six Trailers on Long, Steep Grade

Demonstration of Haulage in Train of Six Wagons Made for Cincinnati Street Cleaning Department

IN ORDER to test the practicability of motor truck and trailer haulage a demonstration for the Street Cleaning Department of Cincinnati was made last August. A section of granite paved street 7000 ft. long, with a mean grade of 6.2 per cent and maximum and minimum grades of 8.3 and 1.8 per cent respectively, was chosen for the experiment. The six trailers used were the ordinary municipal type of dump wagon, as shown in the picture, and the truck was a Knox machine.

In making the demonstration it was specified that there should be no load on the rear wheels of the tractor, and the entire test was made with the whole load trailed and no weight on the tractor platform. The load was pulled by a chain connection between the trailer platform and the hounds of the first trailing wagon, the chain being passed under the rear cross members of the trailer platform and through the bearing plate. With the load drawn, this tilted the trailer platform to the rear to the limit of the stay-chains, but no undue strain on the platform springs was apparent at any time.

In coming down the grade the entire load was held back by the tractor only, the brakes on the trailer not being set at any time. The tractor was brought down the entire length of the 7000-ft. grade in low gear. Two stops were made at the hardest parts of the grades to demonstrate the ability of the tractor to hold back the load. The descent of the grade was made without mishap. Both the jackshaft and rear brakes operated satisfactorily.

The train was started from the bottom of the hill, made the ascent, turned at the top of the hill without stopping and returned to the foot of the hill with the stops noted.

The weights of the trailers used are given below:

Where six wagons, loaded with mud, were used—First two wagons, 11,600 lb.; second two wagons, 18,000 lb.; third two wagons, 16,070 lb.; total, 45,670 lb.

Where five wagons were used—First two wagons, 11,600 lb.; second two wagons, 18,000 lb.; fifth wagon, 8950 lb.; total, 38,550 lb.

MOTOR TRUCK HAULS TRAIN OF TRAILERS UP STEEP GRADE IN CINCINNATI

Colorado District Court Rules Against Luten Patents

Recent Decision by Judge Robert E. Lewis in Washburn Infringement Suit Denies Validity of Seven Bridge Reinforcement Claims

IN A DECISION handed down by Judge Robert E. Lewis of the United States District Court, District of Colorado, in the case of Daniel B. Luten vs. George Washburn and Weld County for the infringement of seven bridge patents held by the complainant, the validity of the Luten patents was denied and the case decided in favor of the defendants, who employed Prof. M. S. Ketchum as technical expert. The opinion was filed Nov. 13.

The decision, which was filed Nov. 13, 1915, after citing the seven patents on which the suit is based—Nos. 852,970, 853,183, 853,202 and 853,203 issued in 1907; 933,771, issued in 1909; 979,776, issued in 1910, and 989,272, issued in 1911, rules out of the case, as of little weight, all previous decisions in favor of the complainant, mainly because they were made "either pro confesso or by agreement, or if not by agreement, it is admitted that no defense was in fact made." Then follows a statement in some detail of the character of six of the patents, the patent 933,771 not being introduced at the trial. The decision contains the following significant paragraphs:

"On consideration of prior patents and publications introduced by the defendants to meet the separate and several claims, I am unable to rid myself of the firm belief and conclusion that each and all of complainant's claims were non-patentable at the time he made his several applications, and also at the two times prior to applications when he claims he first, within two years prior to such applications, made practical use of the claimed inventions in those two instances. The prior patents as anticipations and the prior patents and publications as showing the then state of the art lead to the clear conviction that complainant in each instance only then made application of mere mechanical knowledge and skill, and that what he did is in no sense a demonstration of inventive genius. This is also the opinion of the defendants' expert witness.

PLACING OF STEEL

"The complainant as a witness disclaimed that his patents, or any of them, embodied anything beyond or more than placing 'the steel in a new way that produces better results in a more efficient form. Now, in a concrete bridge the greatest efficiency is always secured by resisting tension or pull with steel rods. That has been established for half a century; not perhaps with curved tension members, but the basic idea is very old. There is no question about that.'

"But none of complainant's patents in its specification, including drawings and in the claims, gives any specific direction as to just where any of the reinforcing members should be placed. This I suppose would in each instance depend upon the maximum load to be carried, the length of the spans, and other elements which involve mechanics only, and would necessarily, I assume, be worked out in determining the amount of compression and tension under the established formula in statics. In a general way the points of greatest stress can be roughly approximated without the use of mathematical tables, but this is centuries old—that is, it is open to common observation, and the fundamental purpose of reinforcing concrete was to strengthen the structure at these points; such a discovery in Luten's day is no evidence of inventive genius.

EARLIER PATENT

"The earliest patent relied upon in anticipation against all of the claims is that issued to Francois Coignet in 1869 (No. 88,547), described in the specification as being improvements in artificial stone, monolithic structures and artificial stone articles, in which the second claim reads: 'The introduction, in the body of artificial stones, or in the body of artificial stone monolithic structures, made of agglomerated artificial stone paste, of skeletons, or metallic frame-work, linked or arranged so as to strengthen the same.'

"I see nothing more than mechanical skill in tying the wings and abutments together, the circular knee-brace in the outer girder with a reinforcing member, binding it to the adjacent abutment and girder, and in carrying the transverse member in the roadway into the outer side of the upper spandrel or girder and upward and over the longitudinal reinforcing member in that girder. In view of the Coignet letters and of the prior state of the art as evidenced by his patent and the publications introduced as above noted, he made specific claim to a 'metallic frame-work linked or arranged so as to strengthen the same.'

"The views above expressed make it unnecessary to consider the defense of non-infringement of some of the claims. It is ordered that the bill be dismissed at complainant's costs."

The Engineering Record has received word from Daniel B. Luten that the case will be appealed.

$600,000 Inquiry Finds Electrification Will Not Solve Chicago's Smoke Problem

Expenditure of $275,000,000 to Abate 22 Per Cent of Visible Smoke Is Considered Unwarranted, but Plan Is Technically Feasible

ELECTRIFICATION of all the railroad trackage in Chicago is financially unwarranted to abate the small air pollution of which the roads are guilty, although the plan is technically possible. This is the conclusion reached as the result of the $600,000 investigation begun four and one-half years ago by a committee of the Chicago Association of Commerce. The committee's $274,440,630 cost estimate is a smoke abatement cost, and all trackage within the city limits and the necessary mileage outside were counted in. If the idea had been to plan an efficient electrification, it is pointed out, the estimate would have been different, and, further, there is nothing in the report to indicate that the electrification of certain roads is not feasible and financially warranted.

Dean W. F. M. Goss, chief engineer of the committee after the death of Horace E. Burt in 1913, and previous to that a member of the committee, has produced a 1177-page report covering every phase of the smoke problem and its relation to the railroads. The Association of Commerce has fathered the investigation, although the railroads have paid for it. The latter and the city each had four representatives, and the association named the remainder of the seventeen members of the committee.

Realizing that any adequate abstract of the contents would be impossible of attainment within a reasonable time, the committee's editor, C. S. Sale, prepared for the press a 15,000-word abstract covering the principal features. This abstract, further condensed, is given below:

Final Conclusions

Some of the final conclusions, aside from the financial ones, are as follows:

That the Chicago electrification would equal the combined electrifications of the whole world, would involve problems never heretofore met, and would be the first ever undertaken for air betterment where terminals were adequate from an operating viewpoint.

That before the steam locomotive is eliminated pollution must first be reduced to a minimum from the three more damaging services, high pressure steam plants, metallurgical and other manufacturing furnaces, and domestic fires.

That the steam locomotive stands third among smoke producing services, using but 12 per cent of the fuel consumed, and that its elimination would reduce the gaseous pollution of the air only 5 per cent and the solid pollution less than 4 per cent.

That electrification, hydroelectric and other long-distance transmission being inapplicable, would add power-house smoke in quantities sufficient to offset much of the gain through eliminating locomotive smoke.

That suburban passenger services, such as those of the Illinois Central and other roads, produce but 1.54 per cent of the total visible smoke, and 1.97 per cent of all the dust and cinders.

That electrification will involve at least 3476.4 miles of track.

That all smoke regulation in Chicago and elsewhere has erred in confining itself to the visible aspects of smoke, whereas the really harmful factors are the invisible gases and the solids of combustion, sulphurous gas and mineral dust in particular.

That, despite the fact that Chicago burns more coal annually than any other large city—8 tons per capita as against 4 for Manchester and 1½ for Berlin—its air is better than that of most large cities, because of the better sun, wind and rain conditions.

That the loop is the smokiest district, with the stock yards and South Chicago a close second and third.

That, in Chicago air, the products of combustion constitute only two-thirds of the total pollution, the other third being due to avoidable and unavoidable dirt from the general activities of the city and from poor municipal housekeeping.

Pure Air Commission the Remedy

It was suggested that the only program by which air pollution may be reduced to the minimum is to create a Pure Air Commission, the membership of which shall be made up of experts whose duties would be to investigate all sources of air pollution, to determine, by experiment or otherwise, the most effective means for mitigating or eliminating such pollution, and that, so far as practicable, it be invested with power to enforce obedience to its decisions.

That no materials shall be employed in paving, without the consent of the commission, to the end that dust-creating pavements may be abolished.

That the paving and cleaning of alleys and other highways shall be subject to the supervision of the commission.

That the commission shall have power to require that the wrecking and erection of buildings shall proceed by methods which will protect the air from all unnecessary pollution.

That the commission shall have the power to require roofs to be cleaned and other minor sources of air pollution to be abated.

That new installations of boiler and other furnaces be permitted only as licensed by the commission, which shall have power, under reasonable rules to determine the character of the installations.

That the commission be charged with the duty of investigating present practice in the construction and operation of domestic furnaces, with a view to so perfecting such practice that fuels now used may be burned without objectionable air pollution, or to so changing the character of present fuels as to accomplish the same result.

That the commission be charged with the duty of investigating the construction and operation of metallurgical and high pressure steam boiler furnaces, with a view to eliminating, so far as practicable, the air pollution for which such furnaces are responsible, and that it formulate and enforce regulations under which such furnaces shall hereafter be constructed and operated.

That the commission be charged with the duty of investigating the pollution of the air by railroad locomotives, by steam boats and by other transportation agencies making use of movable engines, of devising methods of abating air pollution from these sources, and of enforcing such provisions for the suppression of air pollution as may be found necessary.

It is not the opinion that radical action should be expected of the Pure Air Commission, or that action involving abandonment of the use of Illinois and Indiana coal is either advisable or practicable, or that action involving the general abandonment or rebuilding of existing boiler or heating plants, either stationary or portable, is advisable or practicable, or that the immediate or general electrification of railroads for the purpose of eliminating their part in air pollution is under present conditions advisable or practicable, but that all efforts to improve existing conditions shall be carried on with due regard to the responsibility of each of the fuel consuming services for their contribution to the pollution of the atmosphere, and that such changes as may be determined upon may be gradually made, with due regard to financial and mechanical difficulties.

Total Electrification Financially Impracticable

As regards the financial practicability of electrification the committee submits these findings:

(1) The complete electrification of the railroad terminals of Chicago as a betterment to be brought about by the railroads through the investment of free capital is, under present-day conditions, financially impracticable.

(2) Any procedure designed to bring about the complete electrification of Chicago's railroad terminals which is based upon a financial program involving municipal co-operation is, under present-day conditions, impracticable.

(3) Any procedure designed to bring about the complete electrification of Chicago's railroad terminals which is based upon the application of an arbitrary to the traffic of Chicago will constitute a tax which must be borne by the business interests of the city. The practicability of such a tax is a matter which has not been studied by the committee.

(4) The preceding conclusions apply to the complete electrification of Chicago's railroad terminals. The financial practicability, under present-day conditions, of electrification as it might be applied to individual roads or to a single service of individual roads, is a matter which has not been investigated by the committee and concerning which no opinion is expressed.

(5) The credit of the individual railroads, the properties of which make up the Chicago railroad terminals, differs greatly. Some have high credit and could secure funds for almost any project which their

managements might care to propose; others must prove the profitable character of a particular project before underwriters would consider the placement of their securities; others would find it difficult to borrow on reasonable terms even if the particular project for which the funds are sought promises some return; and still others are in the hands of receivers, their administrative function being performed by the courts. These facts cannot be overlooked in estimating what portion of the potential credit of the railroads is available for the purpose of electrification.

(6) Certain railroads making up the Chicago terminals operate entirely within the prescribed zone, while for others the great predominance of traffic lies outside the terminal limits. There is more to this contrast than is implied by the fact that some of the roads involved are switching roads while others are long-haul freight and passenger roads. Complete electrification, from a financial point of view, would affect but a relatively small part of the fixed investments of some roads, while for others it would require practically the rebuilding of the property.

(7) Electrification is a matter which may present greater advantages in connection with certain classes of service than with other classes of service; for example, the electrification of a railroad having a large suburban business would be more effective in developing opinion favorable to the railroad concerned than the electrification of a road the activities of which are wholly those of freight switching yards. A few only depend upon passenger traffic within the city limits for any considerable amount of their revenue. A larger number derive passenger revenue within the terminals from the movement of through passengers only; while other roads perform little passenger service or no passenger service at all.

(8) The extent to which individual railroads have recently made large capital expenditures for terminal improvements, track elevation and enlargement of facilities in Chicago, and the extent to which they are committed to further expenditure for these purposes, must have a material bearing on their ability to make expenditures for new projects.

The committee holds that the city might well be expected to share in the burden of electrification, seeing that it would be undertaken for the public benefit, but a perusal of court decisions shows that this is impossible.

OVERHEAD CONTACT SYSTEM BELIEVED BEST

Notwithstanding the engineering difficulties that would have to be overcome in electrifying the terminals, the committee believes that these difficulties can be surmounted. Its work leads it to the conclusion that the only feasible means of electrification will be by the overhead contact system or trolley. Great obstacles exist to the installation of any system, but it is believed the trolley wire more nearly meets all demands than the third rail. The committee states its conclusions as follows:

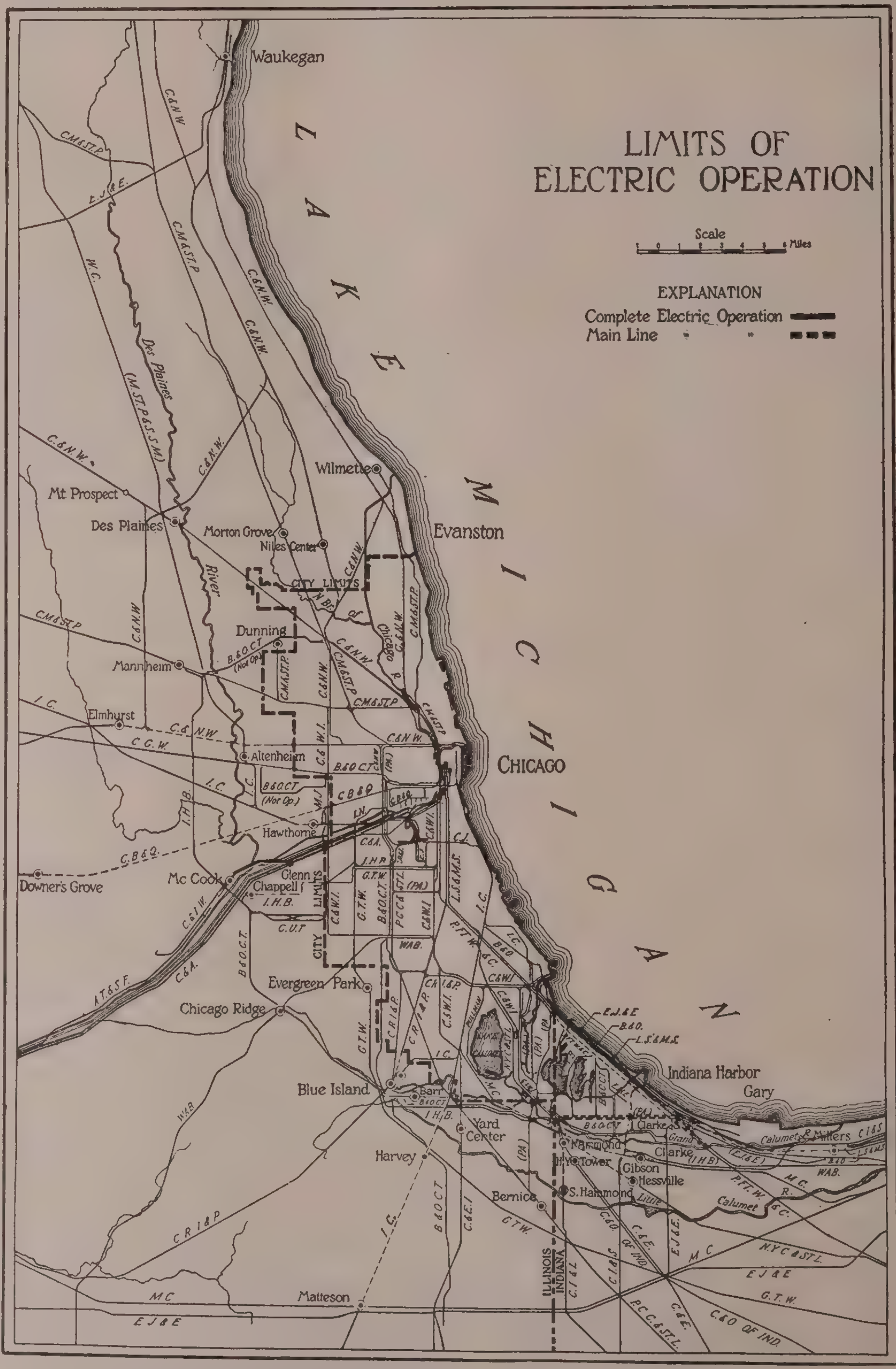
1. A limited mileage of track in Chicago (approximately 1 per cent of the total) cannot be equipped with any system of contact. The electrification of this is not technically feasible.

2. While the third-rail system of contact might be extensively used in Chicago, there are, at intervals throughout a considerable percentage of the total trackage, conditions which would make difficult the use of this form of contact. The third rail is applied with difficulty wherever special track work abounds, where street and railroad crossings occur at frequent intervals, and in switching yards. In locations where employees must be between or must cross tracks, as in freight yards, it constitutes a physical obstruction which is highly objectionable. For these reasons the third rail is not considered feasible for general use in the Chicago terminals.

3. The facts developed show that any form of overhead contact which can be placed high enough above the rail to give the clearance necessary to permit men to ride and perform necessary duties on the tops of freight cars, is not objectionable from a technical point of view. The application of an overhead contact system to the terminals of Chicago, will, however, require the contact wire to be lowered in many places in order that it may pass under structures presenting minimum clearance. The great number of points at which the contact wire must be lowered will require the installation of many warning devices, or the enforcement of rigid rules governing the presence of trainmen on tops of cars.

SMOKE MAP

The study of atmospheric pollution carried on by the committee is said to be by far the most extensive and scientific ever attempted. One of the exhibits produced is a smoke map of the area under investigation. This covers Zone A, which includes all the territory within the city limits, and Zone B, which includes adjoining territory from Gary on the south, through Ham-



SUGGESTED EXTENT OF COMPLETE AND MAIN-LINE ELECTRIC OPERATION

Heavy circles indicate proposed outside limits of main-line electrification.

mond, Whiting and East Chicago, on around through the large railroad yards at Godfrey, Proviso, Clearing and Dolton, to the lake north of Evanston. This map shows just what part each district plays in smoke production. All the figures, both on smoke and on electrification, are for the year 1912.

The total annual per capita consumption of coal in 1912 in the city limits was 7.7 tons. In Zone B, outside the limits, it was 13.7 tons. The average for the two zones was 8.3 tons. The average square-mile consumption of coal within the city limits was 10,797 tons for steam locomotives as against 79,436 tons for all other services combined.

In the industrial centers and the heavily populated districts the steam locomotive coal consumption and smoke production is small when compared with the total volume for all sources. In outlying districts where the population is small and where there is no grouping of industries, the steam locomotive sometimes becomes the greatest smoke producer.

In only four out of the twenty-seven districts do steam locomotives use more than half the total fuel consumed, and these districts are sparsely populated and have very limited smoke producing services other than smoke from residence chimneys.

For the purpose of its investigation the committee considered smoke in the following aspects: Visible smoke, solids in smoke, gases in smoke. Smoke, in each of its phases, was found to have undesirable features. Smoke from each service was found to have a definite relation to the total volume of smoke pollution, both as to quantity and as to particular features of pollution. In order to ascertain which services produced the visible smoke, the solids of smoke and the gases of smoke, and in what proportion 11,976 observations were made of locomotive smoke, 1241 high pressure smoke stacks were put under observation, 2801 low pressure stacks and 280 stacks of metallurgical and other furnaces.

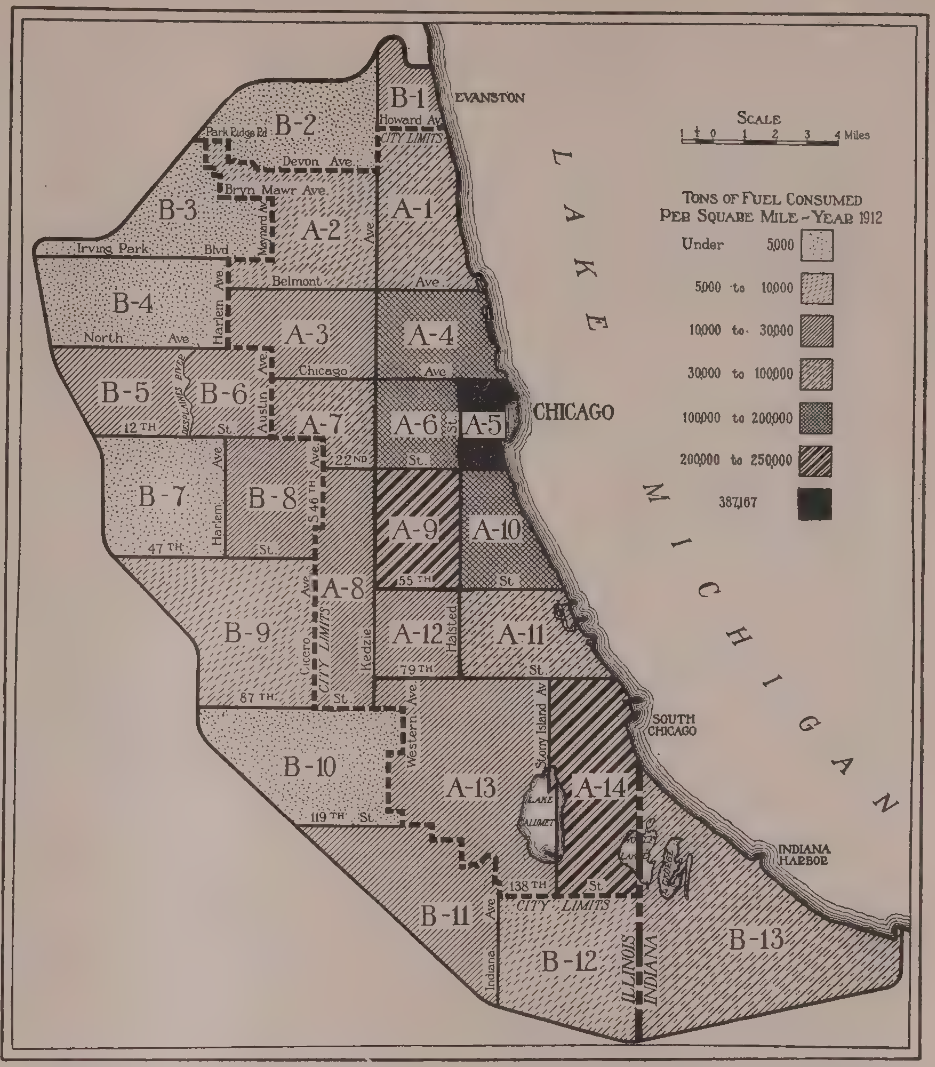
The following table shows the results of these observations:

WHO MAKES CHICAGO SMOKE?*

Responsibility of each service for smoke pollution within Chicago, on percentage basis

	Visible smoke, per cent	Solids of smoke, per cent	Total of smoke, per cent	Gaseous carbon, per cent	Gaseous sulphur, per cent
Steam locomotives	22.06	7.47	10.31	10.11	18.22
Steam vessels....	0.74	0.33	0.60	0.55	0.45
High pressure steam stationary power and heating plants......	44.49	19.34	44.96	40.68	53.70
Low pressure steam and other stationary heating plants......	3.93	8.60	23.00	23.06	19.73
Gas and coke plants	0.15				
Furnaces for metallurgical, manufacturing and other processes.	28.63	64.26	21.13	25.60	7.90

*One-third of all air pollution is due to dirt other than that of combustion. These percentages refer to the remaining two-thirds.



FUEL-CONSUMPTION AND SMOKE MAP OF 27 DISTRICTS IN AND AROUND CITY

A-5, the down-town district, is the worst; A-9, the stock yards, and A-14, South Chicago, rank next.

FALLACY OF VISIBLE SMOKE AS AIR POLLUTION INDICATOR

A significant fact disclosed by the researches of the committee is that which emphasizes the relatively great importance of the solid constituents of smoke. Hitherto most discussions concerning smoke, and practically all measures designed to show the extent of atmospheric pollution resulting from it, have dealt only with its cloud effects. It now appears that the cloud effects are of secondary importance, as compared with effects produced by the soot and dust of smoke. The problem of smoke abatement, therefore, as viewed in the light of the committee's disclosure, is not entirely or largely a problem of suppressing visible smoke, but is one of suppressing the shower of soot, dust and cinders constantly falling from a smoke-polluted atmosphere.

Smoke arising from solid fuels was found to be never free from such solids. The amount of solids discharged has no direct relation to visibility. A stack may appear smokeless to the eye, it is said, and yet be the source of a heavy discharge of dust. The adoption of anthracite coal or of coke as a fuel, the committee asserts, will serve to make stack discharges invisible but will not eliminate the dust discharge.

Owing to the finely divided state of the solids emitted in the smoke of high-pressure steam stationary power and heating plants, says the report, the resulting pollution may be regarded as affecting wide areas, since such materials are easily carried by the wind and air currents. Chemical analyses of the solid materials emitted in the smoke of high pressure steam stationary power and heating plants indicate that the discharges contain 60 per cent of ash, 33 per cent of combustible carbon or particles of unconsumed fuel, 4 per cent of sooty materials condensed from the distillates of fuel, and 3 per cent of sulphur.

It has been estimated that within the city of Chicago there are approximately 17,000 high-pressure (10 lb. or more) steam boilers, served by not less than 11,000 smokestacks and more than 11,000 low-pressure steam boilers.

There are also several hundred thousands domestic heating furnaces and stoves in houses and stores. In point of number of establishments, therefore, the service included by the classification "low pressure steam and other stationary heating plants" is many times larger than any other service considered in the committee's investigation.

SMOKE CONTRIBUTED BY ENGINES

The following is a summing up of the contribution of locomotives, in various services, to the smoke nuisance:

Locomotives engaged in suburban passenger service contribute 1.54 per cent of the total visible smoke, 1.97 per cent of the total dust and cinders of smoke, and 0.74 per cent of the total polluting gases of smoke discharged annually into the atmosphere of Chicago. Similar percentages for other services follow:

Locomotives engaged in through passenger service contribute 2.07 per cent, 1.80 per cent, and 0.89 per cent respectively.

Locomotives engaged in all passenger

services combined, including suburban passenger, through passenger and passenger transfer, contribute 3.80 per cent, 3.81 per cent and 1.73 per cent respectively.

Locomotives engaged in road freight service contribute 2.01 per cent, 1.18 per cent and 0.66 per cent respectively.

Locomotives engaged in yard freight service contribute 10.25 per cent, 1.73 per cent and 5.17 per cent.

Locomotives engaged in all freight services, including road freight, yard freight and freight transfer services, contribute 16.85 per cent, 3.34 per cent and 7.57 per cent.

No Substitutes for Steam Satisfactory

As a preliminary to its study of electrification for Chicago steam roads the committee made an investigation into other methods of conducting transportation. It had been hoped that some type of self-propelling motor might be found, and the danger, engineering difficulty and expense of electrification be avoided. But this hope was not justified.

While it was found that progress had been made in adapting the gasoline engine to the requirements of light or special railroad service, the power requirements of heavy and diversified traffic, it is stated, are still beyond the gasoline-driven unit. The Diesel oil-burning marine engine has the power but neither type is self-starting, an imperative requirement for switching work. A new Diesel experimental locomotive was examined in Switzerland. Much had been hoped from it, but the inventor himself was doubtful of its success in such heavy yard switching work as would be required here and to limit its future to light express work with constant speeds and infrequent stops.

Much, also, had been hoped from the storage battery, but it was found to lack power, to be too expensive and to share, with electrification, the disadvantage of producing power house smoke. The internal combustion motors are also smoke producing and are regarded as adding a new hazard of operation through their fuel tanks. Compressed air and hot water motors were found impractical, but their use is suggested on those sections of Chicago track that cannot be electrified.

"There is available at this time," says the report, "no form of locomotive carrying its own power capable of handling the traffic of the Chicago railroad terminals, which could be substituted for the steam locomotive, and there is no prospect of the immediate development of any such locomotive."

Central Power Plant

"The electric operation of Chicago's railroad terminals must depend upon the existence and operation of a steam-driven electric generating station. The conclusion has been reached that a single power-station, located near the south branch of the Chicago River in the vicinity of Ashland Avenue, would satisfactorily meet all requirements. The load center, under the plan of electrification as already defined, falls within the limits of the Union Stock Yards. The location indicated is not far from this point and is such as satisfies other requirements of the problem."

The committee finds that steam locomotives, in 1912, consumed within the city 2,099,044 tons of coal and that, for the single central power station, 807,762 tons would be required, the net saving being 1,291,282 tons.

The committee finds that it would make no practical difference whether the roads manufactured their own electric power or purchased it from public-service corporations.

Mileage

The committee's plan contemplates the electrification of all track within the city limits and the conclusion of electrified trackage on each railroad as close outside the city limits as is practical. The mileage involved by this conception may be summarized as follows:

	Miles
1. Main track	1,475.59
2. Yard track	1,456.64
3. Industrial track owned by railroads	277.19
4. Industrial track owned by industries	229.72
5. Industrial track, railroad repair track and shop track so located in streets at grade, in buildings or under structures employed in industrial processes as to require some type of self-propelling motor	37.26
Total	3,476.40

While in general the committee decided to terminate electrification at the first convenient point outside the city limits, this could not be accomplished on certain roads which conduct a suburban passenger service. It would be impracticable, according to the findings of the committee, to operate these frequent suburban trains part way by electricity and part way by steam. It has hence been decided that certain lines must be partially electrified beyond the limit of complete electrification, to the terminals of the suburban service. Through passenger and all freight trains are to be operated by steam on the partially electrified extensions, which will be for use only by multiple-unit suburban trains, resembling "L" trains, but of heavier construction.

Systems of Electric Traction

As yet no system of electric traction has been developed, the committee finds, which can be accepted as standard for all conditions on all railroads. If it were decided to proceed at once with the electrification of the Chicago terminals, it would be difficult for any group of men, the committee believes, to choose a system which would not be criticised by other men as able as those upon whom the choice of the system developed.

The system selected for Chicago, it is pointed out, must be suitable not only for passenger terminals and through line work but also for yard switching and transfer work. It must be applicable to the requirements of railroads having a heavy suburban traffic, and also to those roads conducting freight yard and switching service. It must not only be satisfactory in its application to the terminal portion of a trunk line railroad, but it must lend itself to an indefinite extension of the limits of electrification over other and adjoining portions of the road.

Obviously, the report adds, the project must be regarded as too important to permit of the introduction of methods in any way questionable, or of a type of construction of untried value. Furthermore, it is not permissible to consider any methods which might serve to tide over a temporary condition anticipating the later selection of a permanent and stable system.

The committee, after obtaining complete engineering data on these three systems selected the third as cheapest and most desirable:

1. Third rail contact, direct current at 600 volts.
2. Overhead contact, direct current at 2400 volts.
3. Overhead contact, single-phase current at 11,000 volts.

The third-rail system was given up as the least practical of the three, because of the difficulties to be met. Not only would the presence of the third rail be a danger to employees in the yards and make necessary a large amount of reconstruction, but there would be trouble in operating trains, owing to the large number of gaps in the third rail due to switches, street intersections and other such obstructions.

The difficulties of trolley installation would also be great, but less, it is believed, than those attending the use of the third rail. The great trouble found is with low bridges and other structures over the tracks.

Within the area of investigation there are 492 permanent structures which fail to have sufficient clearance over tracks to allow the installation of the overhead conductor at the desired height of 24 ft. 2 in. Of these obstructions, 221 cannot be changed without great inconvenience and expense both to the city and to the railroads. There are 385 structures which have clearances of less than 25 ft.; 163 of these interferences can be changed to provide the desired clearance, but not without material expense, and 222 cannot be changed without great inconvenience and expense. There are seventy of these structures which have less than the minimum clearance of 16 ft. 6 in. permissible where trainmen are excluded from tops of cars. The conclusion follows that a sufficient clearance to permit employees to ride on tops of cars cannot be obtained throughout the Chicago terminals.

The adoption of the overhead contact (trolley) system would permit the use of either a high voltage direct current or an alternating current of much higher voltage. The use of the first would result in damage to property by electrolysis. The use of the second would "kill" telephone and telegraph wires adjacent to the tracks, through inductive interference. Both conditions could be remedied, though with difficulty and at considerable expense.

Precipitated Costs

Following the work of the committee, a number of the Chicago railroads have made a study of the cost which would be imposed upon them in excess of those set forth by the committee. Eight of these railroads have filed with the committee the results of their investigations. The excess costs, including costs due to extension of the plan and precipitated costs, in per cent of those which are covered by the committee's estimates were 54.07 per cent. The committee's estimates of the net cost of electrification for all the roads of Chicago total $178,127,230. Therefore, carrying forward the same ratio, the committee finds that the total added and precipitated costs for all the railroads would amount to $96,313,400.

For example, in fixing the limits to be observed by the Chicago, Burlington & Quincy Railroad, the committee has specified complete electrification to a point 6.8 miles (Hawthorne) beyond the boundaries of the city, and partial electrification to provide for suburban service only to a point which is 21.3 miles (Downers Grove) from the city terminal. In reviewing the work of the committee, the officers of this road have reached the conclusion that if they were required to electrify, it would be necessary to provide for the electric operation of freight service to a point 33.4 miles (Eola) from Chicago and for suburban service to a point 37.4 miles (Aurora) from the city terminal.

By far the most important factor in this list of indeterminate costs is that of terminal rearrangement and improvement. The city's terminals have grown up without preconceived plan, additional facilities being added now and then at points farther out as the expansion of business and of the city dictated. Many of these changes might not become imperative for a decade, but under electrification would have to be made at once. Track elevations would be extensive in order to avoid grade crossings with trolley lines. Signal systems that are now somewhat out of date, but might be continued in operation for a number of years, will have to be altered and it is probable many roads will decide to put in entirely new systems.

According to figures from the Michigan Central these additional costs—not included in the committee's estimate—would amount to $5,000,000. The Burlington places its additional costs at $2,501,080. The Chicago & Alton would, according to the estimates of its engineers, have to spend an additional $820,000, the Illinois Central several millions, and the Chicago & Western Indiana $10,000,000, which would otherwise be strung along through a series of years. The North Western, which has made complete estimates, paralleling these of the committee, figures its total costs would be 30 per cent more than those of the committee's report.

On the staff of the committee under Dean Goss were L. H. Evans, terminal engineer; Hugh Pattison, electrical engineer; Theo. H. Curtis, mechanical engineer; James Walker, assistant engineer; Gibbs & Hill, consulting electrical engineers; George R. Henderson, consulting mechanical engineer, and W. M. Whitenton, operating engineer. Judge Jesse Holdom was chairman of the committee.

California Has Sanitary Bureau

A SANITARY engineering bureau in California was established by the recent Legislature, which appropriated $30,000 for its maintenance. The new bureau will act under the State board of health and will include among its duties the examination of all water-supply systems having more than 200 service connections. All such systems require a permit from the Board of Health, application for which must be accompanied by a full description of the works, including all sanitary conditions. The State board may make such investigation as it considers necessary and must give a permit if the water is found to be pure. It shall deny the permit if the water is unsafe, but in such a case may grant a temporary and revocable permit under such restrictions and conditions as may be specified in order that time may be given for investigation and the installation of a safer supply. Such conditions imposed, might include chlorination.

THE DIAGRAM FOR E-50 SHEARS AND MOMENTS in the Engineering Record of Nov. 20, page 633, should be corrected by changing the unit given on the left for the ordinates of the maximum moment diagram to read "thousands of foot pounds" instead of "thousand pounds."

Making Motor Truck Pay on Short Hauls

Efficiency Test of Motor Truck on Short Haul Work Produces Record of 384 Tons Hauled in 8 Hours—What a Cartage Company Is Doing in Its City Work

TO test the efficiency of motor trucks on short-haul work a Chicago teaming contractor sublet his teaming contract to the Arrow Motor Cartage Company at 40 cents a yard, the prevailing team rate in Chicago on hauls of less than 1 mile. The data given herewith apply to the performance of the latter company's motor trucks and show how a 5-ton Pierce-Arrow machine made sixty-four 1-mile trips, hauling 384 tons of gravel and sand in a little less than 8 hr.

CONDITIONS ENCOUNTERED

The motor truck's task consisted in furnishing a continuous supply of materials for a section of concrete road on Western Avenue ⅜ mile long. Paralleling Western Avenue and one block west of it are the team tracks of the Baltimore & Ohio Railway, from which the materials were hauled, extending one block south of the south limit of the work. Western Avenue is traversed by a double-track street car line. As only one concrete mixer was assigned to the work the two roadway sections were handled separately, the work progressing up one side and down the other.

The mixer, of course, was always a little in advance of the newly laid base, while the storage piles of gravel and sand were placed still farther ahead. A fixed route for the motor truck was quickly decided upon and followed throughout the day. After receiving its load at the team track it proceeded north to the end of the railroad yard, then east to Western Avenue and north on the street car tracks to the point of dumping.

QUICK LOADING METHOD

At the team track the truck was loaded directly from the railroad cars by Lee loaders. Each loader consists of a collapsible steel framework mounted on wheels, which is placed alongside the car to be unloaded. On top of this standard is carried a large sheet metal bucket, which is tipped toward the car while being loaded and away from it while being dumped. In unloading a car one loader is placed alongside it at each end, so that the shovelers inside the car work from the ends toward the center. In some cases three loaders are used. It is estimated that ordinarily three good shovelers can fill a 2-yd. loader in 16 min., each man having a capacity for handling 25 cu. yd. in 10 hr. When the car is about half empty the loaders are moved toward the center of the car, the two shoveling crews still remaining on their respective sides of the central pile of material.

THE LOADING SEQUENCE

On the day in question, when 384 tons were handled, a crew of sixteen shovelers with four 2-yd. loaders was employed, four men being assigned to each loader. Under these conditions one loader could be filled in about 12 min. Sixteen men were deemed advisable because the weather was extremely hot, although twelve exceptionally good shovelers could have done the same work without delaying the machine.

Each pair of loaders delivered a complete load on every second trip of the motor truck, the two sets being filled and dumped alternately. Two complete round trips of the machine required about 15 min., so that each crew of eight shovelers, after filling its two loaders in 12 min., had a respite of about 3 min. before the arrival of the machine for its load. This gave the men an opportunity for rest and provided a reasonable margin of safety in case the machine should return sooner than expected. By taking alternate loads in this way from the same crew on one car delays were avoided and the supply was able to keep pace with the demand.

This 3-min. margin of safety also provided time to allow for moving the loaders from the ends of a car to the center and from one car to another. Such a change requires simply that the stay chains be released and the loaders be rolled into and chained in their new positions. It can easily be accomplished in 2 min. by two or three shovelers.

CONDITIONS IN RAILROAD YARD

The team track from which the loads were taken is a block long, and this fact caused some variation in the length of the individual trips. The north end of the track is on a level with Thirty-fifth Street, but the rails lead up a slight grade all the way to Thirty-sixth Street, where the switch connects with the elevated tracks of the main line.

Of the nine cars unloaded during the day four containing only 3¾ carloads of material were spotted during the forenoon at the upper or Thirty-sixth Street end of the switch. The average haul in working from these four cars was a little over 1 mile. The five cars unloaded in the afternoon were spotted at the lower or Thirty-fifth Street end of the switch. This made a difference of nearly two blocks in the length of each trip, bringing the average round-trip haul to about ⅞ mile.

This variable factor in the length of haul was confined to the railroad yard and affected only a few of the items shown in the accompanying table. The remaining portion of each trip was practically identical with respect to mileage.

As delivered on the team track by the railroad company the day's consignment consisted of nine cars containing 8¾ carloads of material, two of sand and six and three-quarters of No. 9 gravel. These materials were taken away by the motor truck in the approximate proportions as used in the work, two loads of gravel and one load of sand, followed by more gravel and more sand in the same proportion, with occasionally an extra load of one or the other according to the requirements of the mixer. This demanded some shifting of loaders from one car to another which would not otherwise have been necessary.

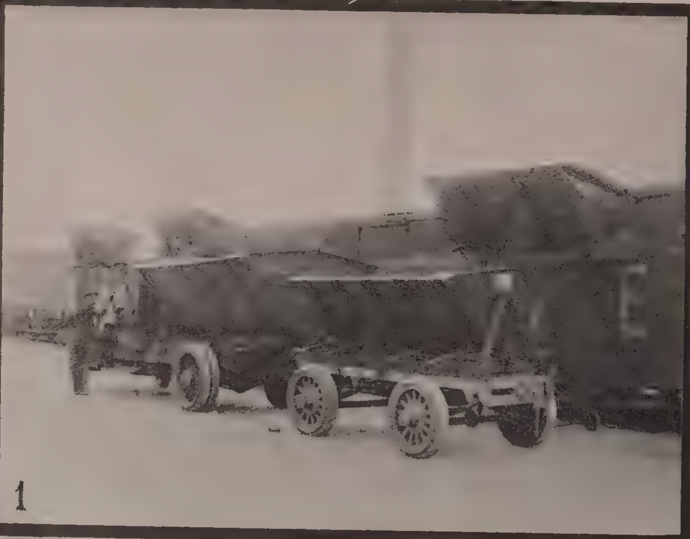
LARGE CREW PREVENTS DELAYS

An early analysis of the conditions showed the advisability of employing a sufficient number of laborers to preclude any possibility of delay to the machine. Sixteen shovelers were used when twelve might have done the work. By using the larger crew a reasonable factor of safety was introduced and the risks of interruption, while not eliminated, were reduced to the minimum.

Similarly, at the dumping place, an extra man was put at work. His business was to open the tailgate of the motor truck when it arrived and to put in place the block that was used as a platform in dumping. The part of the street on which the material was dumped was several inches lower than the street car tracks, and it was necessary to dump the load in such a way that the pile would not spread over them. This was accomplished by backing the machine in at an angle while the extra laborer at the dumping point placed the block under the overhanging rear wheel. Twisting of the chassis frame was thus avoided and no undue stresses were imposed upon the body hoisting mechanism. At the same time the load was dumped clear of the car rails and in a convenient position for the mixing gang.

The dump body employed is operated by the power of the motor truck engine and can be controlled by the driver without leaving his seat. The device is also arranged so that after discharging the load the body can be lowered to its normal position while the machine is moving forward on its return journey. This provision played a small but important part in making the record day's work possible.

The great saving by the reduction of idle time was accomplished at the loading end.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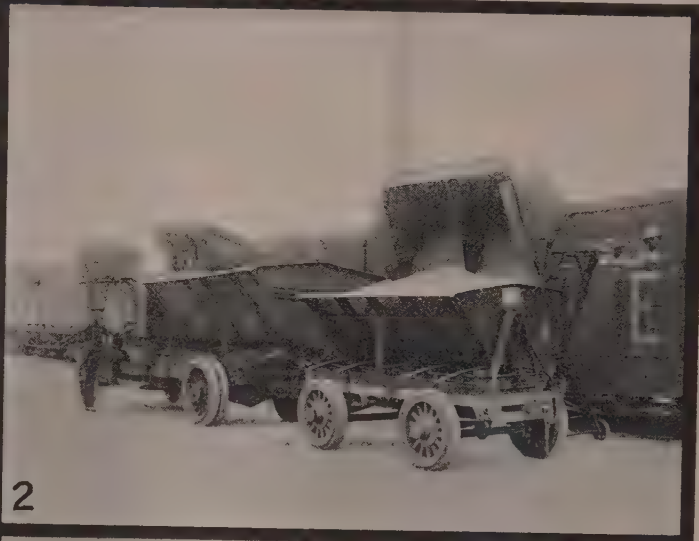
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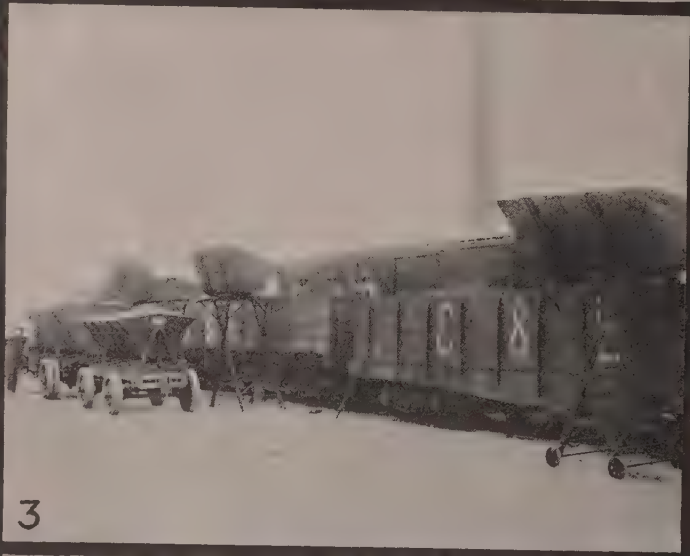
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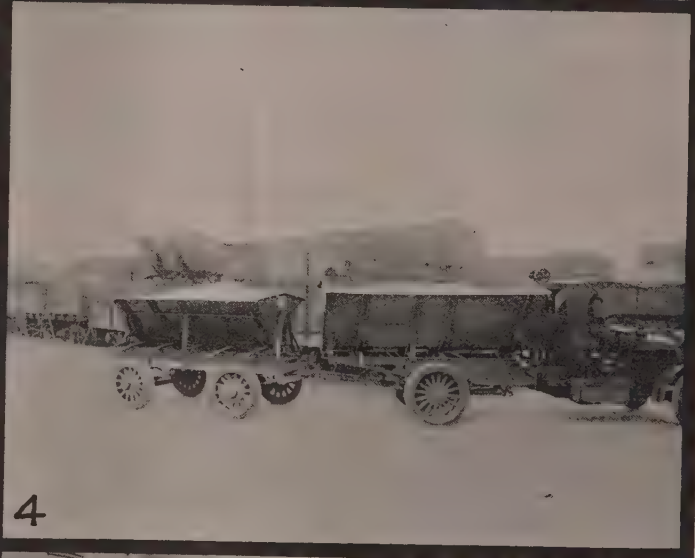
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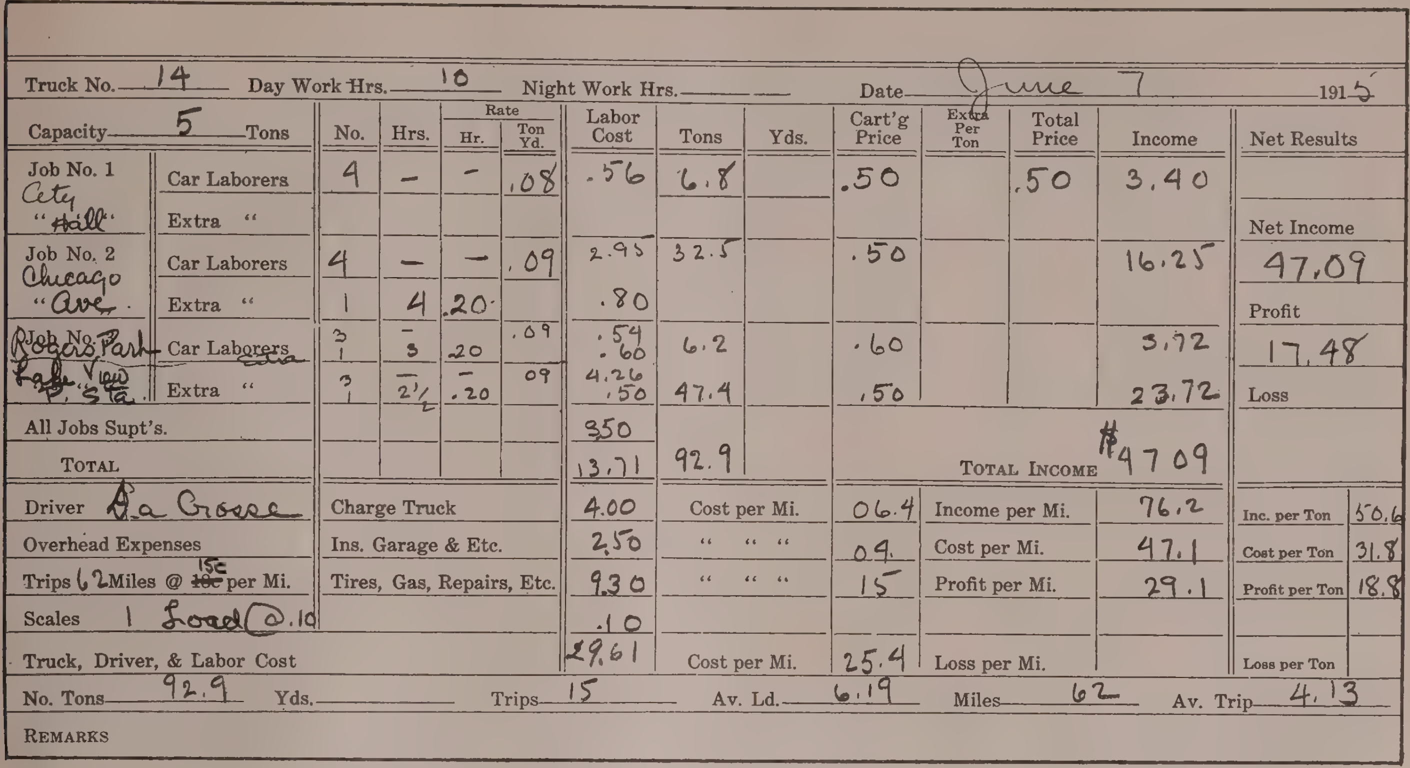
1. AT RAILROAD YARD READY FOR LOAD
3. TRAILER LOADED—LOADING TRUCK
5. DUMPING AT THE JOB

2. HOW TIME WAS SAVED IN LOADING
4. OFF FOR THE JOB
6. RETURNING FOR ANOTHER LOAD



Truck No. 14 Day Work Hrs. 10 Night Work Hrs. Date June 7 1915

Capacity 5 Tons		No.	Hrs.	Rate Hr.	Rate Ton Yd.	Labor Cost	Tons	Yds.	Cart'g Price	Extra Per Ton	Total Price	Income	Net Results
Job No. 1 City "Hall"	Car Laborers	4	–	–	.08	.56	6.8		.50		.50	3.40	
	Extra "												Net Income
Job No. 2 Chicago "Ave.	Car Laborers	4	—	—	.09	2.95	32.5		.50			16.25	47.09
	Extra "	1	4	.20		.80							Profit
Job No. Rogers Park	Car Laborers Extra	3 1	– 3	.20	.09	.54 .60	6.2		.60			3.72	17.48
Lake View P. Sta.	Extra "	3 1	– 2½	– .20	09	4.26 .50	47.4		.50			23.72	Loss
All Jobs Supt's.						350							
TOTAL						13.71	92.9				TOTAL INCOME	$47 09	

Driver La Grosse	Charge Truck	4.00	Cost per Mi.	06.4	Income per Mi.	76.2	Inc. per Ton	50.6
Overhead Expenses	Ins. Garage & Etc.	2.50	" " "	04	Cost per Mi.	47.1	Cost per Ton	31.8
Trips 62 Miles @ ~~10c~~ 15c per Mi.	Tires, Gas, Repairs, Etc.	9.30	" " "	15	Profit per Mi.	29.1	Profit per Ton	18.8
Scales 1 Load @ .10		.10						
Truck, Driver, & Labor Cost		29.61	Cost per Mi.	25.4	Loss per Mi.		Loss per Ton	

No. Tons 92.9 Yds. Trips 15 Av. Ld. 6.19 Miles 62 Av. Trip 4.13

REMARKS

HOW ONE CONTRACTOR KEEPS HIS MOTOR TRUCK COST RECORDS

It was possible to perform in 30 sec. or less with the portable loaders what would have required all of 15 min. without them. Although it needed on an average only 12 min. for shoveling 4 yd. of material into the buckets, 15 min. or more would have been necessary had the shoveling been done direct from the cars into the motor truck. By reducing the length of the shovel throw the loaders lowered the shoveling time by 20 per cent and increased the shoveling capacity of each man by an equal amount.

The machine handled 256 yd. or 384 tons of material in 8 hr., or 1 load of 4 yd. every 7½ min. At 10 cents a yard the Arrow Motor Cartage Company earned on this day's performance a gross sum of $102.40. This at the rate of $12.80 an hour, or 21 1-3 cents a minute.

ANALYSIS OF MOTOR TRUCK'S USEFUL AND WASTED TIME

Morning Work—24 Trips

Operation	Trips Considered	Best Time M—S	Worst Time M—S	Average Time M—S
Maneuvering for load....	22	:50	2:25	1:07
Loading	21	:20	1:01	:26
Maneuvering after loading	22	:20	1:10	:23
Running time out........	22	1:20	3:05	1:58
Maneuvering for dumping	24	:10	1:35	:25
Dumping	24	:15	:50	:25
Maneuvering after dumping	24	:05	:55	:18
Running time back.......	22	1:15	3:00	2:01
Loading and unloading...	21	:40	1:25	:56
Maneuvering, loading and unloading	22	1:10	3:25	1:31
Running time out and back	21	3:10	5:20	4:04
Running and maneuvering time	21	5:30	7:40	6:04
Trip time (all items)....	20	6:30	9:10	7:48

Afternoon Work—40 Trips

Operation	Trips Considered	Best Time M—S	Worst Time M—S	Average Time M—S
Maneuvering for load....	37	:10	1:05	:32
Loading	36	:15	1:00	:30
Maneuvering after loading	40	:05	1:05	:31
Running time out.......	40	1:00	2:40	1:46
Maneuvering for dumping	39	:10	1:10	:37
Dumping	40	:10	1:15	:20
Maneuvering after dumping	40	:05	1:15	:24
Running time back......	40	1:05	3:50	2:20
Loading and unloading..	37	:30	1:55	:54
Maneuvering, loading and unloading	37	:15	2:00	1:02
Running time out and back	40	2:35	5:15	4:29
Running and maneuvering time	37	4:25	7:20	6:00
Trip time (all items)....	36	5:30	9:00	7:14

LOST TIME COSTS MONEY

An example of what the lost minutes mean can be seen in the irregular trips. Because the supply of sand became exhausted two trips, 20 and 21, to a distant yard were necessary. Together the two trips consumed 49 min. 40 sec., or 34 min. 40 sec. more than two normal trips. Here was a direct loss of $7.38. Then, waiting for material between 10.25 a. m. and 12.47 p. m. consumed 2 hr. 20 min., worth $29.63. These avoidable losses were deducted from the total elapsed time, giving the actual working time of approximately 8 hr.

On trip 1, due to hand shoveling direct into the motor truck, 17 min. and 45 sec. were wasted, a loss of $2.64. On trip 19, traffic delays cost nearly 7 min., or about $1.47. On trip 37, waiting for buckets cost almost 9 min., or nearly $1.89. Hundreds of other leaks—some avoidable and others not—contributed their share in holding down the efficiency of the machine. The mere difference in the length of the morning and afternoon hauls cost nearly $2.50.

The significance of avoiding time leaks is illustrated in the accompanying table. The average time for each morning trip was 7 min. 48 sec. For the afternoon trips it was 8 min. 14 sec. The average for the day was 7 min. 31 sec.

The best time made on any morning trip was 6 min. 30 sec. The best time for the afternoon trips was 5 min. 30 sec. The average of the two is 6 min. This is 1 min. 30 sec. better than the actual average. On the day's work of 64 trips this difference would have increased the motor truck's earnings by $20.32, or more than enough to pay the cost of operating the machine.

During the week of Oct. 18, 1915, the cartage company hauled 1571 tons of coal and 738 cu. yd. of gravel to twelve different jobs, making 467 trips averaging 875 miles with one 5-ton Pierce-Arrow truck and a Troy trailer of 3½ cu. yd. capacity. The gross income for the week was $1,058.56 and the net profit $336.09.

ADAPTATION TO CITY WORK

The truck is equipped with a three-way dumping body of 8 cu. yd. capacity that was built for hauling coal to a pumping station. In hauling gravel about 5 cu. yd. composed the truck load. The advantage of the side dump for city work, according to the contractor, lies in its ability to dump clear of the tracks when working along street car lines. The material clears the wheels, piles up high and does not spread over a large flat area. The length of the train shown in the accompanying photograph is 33 ft. The average speed attained is 12 miles per hour and the maximum 14 miles per hour. The truck runs as fast with the trailer as without, and according to the records the trailer adds very little more to the fuel cost. The average speed of the truck loaded is about the same as when empty. The men at the loaders are paid 11¼ cents per yard of stone, sand or gravel.

STREET-CLEANING DATA on seventeen American cities compiled by the committee on standard forms of the American Society of Municipal Improvements indicate that an average of 16,462 sq. yd. of pavement per sweeper and driver were covered per day. The contributing population was 1785 and the sweepings amounted to 29.76 cu. yd. per 1000 sq. yd. per year. Only ten cities gave information on this last point, the amounts varying from 12.3 cu. yd. at Washington to 58.9 cu. yd. at Boston. Average figures obtained for refuse collection are 2296 persons per collector, 2477 cu. yd. per collector per year and 1141 cu. yd. per 1000 population per year. The last item varied from 128 at Erie to 1780 at Toronto.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Are Timber Pads Under Crushing Machinery Desirable?

SIR: The writer would appreciate a discussion in these columns upon the use of timber pads under crushing machinery. The manufacturers of these machines call for timber pads between the base castings and the concrete piers. There are several reasons why the use of timber for such purposes is objectionable, and the writer does not see any logical reason why, in most cases, these pads may not be left out, the machines bolted directly to the piers, and the vibration transmitted through the pier to be absorbed in the earth. Is it not a fact that the use of these pads is a survival of a theory which may be questioned?

J. MASTELLA LE GRAND,
Designing Engineer, United Verde Copper Company.
Clarkdale, Ariz.

Sand for Concrete

SIR: I have read with keen interest the article on sand for concrete, by Prof. Robert H. McNeilly, in your issue of Nov. 27, page 659. These observations are, in a large measure, confirmed by results which have been obtained in our laboratories in making commercial tests of sand during the past several years.

The accompanying tests illustrate the value of a high content of material passing the ¼-in. sieve and retained by the No. 10 sieve, and also indicate that a notable quantity of dust passing the No. 100 sieve is not necessarily detrimental to the quality of the aggregate. These tests were made on two samples of crushed limestone. They were manufactured from the same stone, the only difference between them being the method of screening.

GRANULOMETRIC ANALYSIS

Sieve number	Per cent passing "Run of crusher"	Per cent passing No. D material
¼-in.	95.0	100.0
10	56.0	97.0
20	48.0	73.0
30	41.0	44.0
40	35.0	20.0
60	28.0	6.0
100	20.0	5.0

COMPARATIVE TENSILE TESTS, POUNDS PER SQUARE INCH

(Briquettes stored 1 day in air and 6 days in water)

	1 part cement, 3 parts Ottawa sand, 9.2 per cent water	1 part cement, 3 parts No. 10 material, 12.5 per cent water	1 part cement, 3 parts "run of crusher," 12.5 per cent water
	315	250	280
	320	235	290
	300	250	265
	325	260	300
	330	235	285
Average	318	246	284
(Briquettes stored 1 day in air and 27 days in water)			
	405	465	465
	435	465	485
	415	455	475
	430	445	490
	400	460	510
Average	417	458	484

In commenting on these tests I would point out that the "run of crusher" contains 41 per cent of material caught between the ¼-in. and No. 10 sieves, and 35 per cent of material passing the No. 40 sieve. This material is, therefore, fairly close to Professor McNeilly's preferred sizing.

The material designated "run of crusher" has been for several years in very successful use for fine aggregate in concrete, and although users are at first reluctant to use it, it is considered by many users of several years' standing to give far better concrete than natural sands from the same locality.

Although for the sake of convenience in sand testing tensile tests are usually employed, I have, for several years, been doubtful of their value in forming a true opinion as to the quality of sand. We have had several cases wherein sands which made a very poor showing in comparative tests with Ottawa sand gave high values when tested in concrete in the form of 6-in. cubes or 8 x 16-in. cylinder specimens. I feel that comparative compression tests for sand mortars should be substituted for comparative tensile tests.

The conclusion of Professor McNeilly that a point exists above which an increase in the proportion of cement causes a weakening in the mortar, has been confirmed on numerous occasions in this laboratory. In a series of comparative compression tests, the specimens being 8 x 16-in. concrete cylinders, it was found that with reasonably good fine aggregate an increase in cement resulted in lower compression values at 30 and 90 days. It was only with fine aggregates of extremely poor quality that an increase in cement showed higher strength under compression. The first series of cubes were on the 1:2:4 basis, while those containing a higher portion of cement were on the 1 1/16:2:4 basis.

E. L. CONWELL,
Vice-President, Henry S. Spackman Engineering Company.
Philadelphia.

Opinion Testimony of Engineers and Economists

SIR: In your issue of Nov. 20, page 645, Prof. John H. Gray, University of Minnesota, is reported as having expressed at the recent conference in Philadelphia on valuation, his views on "Opinion Testimony," which are nothing short of arrogant.

I quote from your report: "As applied to valuation, he said the so-called expert testimony of engineers was incompetent; that if value was related to any science it was the science of accounting or economics, but not engineering; that engineers were not trained to a knowledge of wealth or value, and that their expert testimony along these lines was universally regarded by economists as unscientific."

My first comment is, so much the worse for the economists of Professor Gray's class. I have no doubt that many of the book-economists, men who have cultivated in their minds certain theories by reading each others' books, would so disqualify engineers and all others outside of their little circle, provided they had the power.

But there are economists and economists. Judge Prouty, formerly chairman of the Interstate Commerce Commission, and now chairman of the government valuation board, and Professor Daniels, now a member of the Interstate Commerce Commission, and formerly a professor of economics in Princeton University, have lately expressed the opinion in public addresses that engineers, by reason of their training and experience, are the ones best qualified to testify on values.

Again quoting from the report, "He held that they (engineers) were not disinterested witnesses, being well paid for their opinions, and hence being in effect assistant counsel testifying." Do professors of economics testify without pay? I have the impression that some of them are being well paid for their services and that they are peculiarly open to the charge of mental dishonesty. I should be sorry indeed to believe that on the average the engineers who give opinion testimony are as incompetent and unfair as some of the professors of economics who enter this field.

If there is selected an engineer who is a specialist and a broadly educated man, who has had a wide experience in design, construction and operation, and so has had his theories, designs and constructions tested in the fire of operation and practice, it hardly seems to be open to question that he must be better qualified to advise on values than a book-economist who has never been called upon to make good on the theories he has so glibly expounded to his students.

Does Professor Gray imagine that because a man is an engineer he is thus shut out from a knowledge of accountancy and economics? If so, then the facts disprove his contention. There are in the United States a large number, increasing year by year, of administrative engineers who possess a knowledge of accountancy that is not a matter of textbooks alone, but is qualified, tested and strengthened by the constant demand for the solution of vexing questions.

ALEX. C. HUMPHREYS,
President, Stevens Institute of Technology.
Hoboken, N. J.

Bridge Patent Hearing to Begin About January 1

SIR: Your issue of Nov. 20, page 645, contains an item concerning the investigation the Senate Committee will make concerning the fraudulent obtaining of patents by Daniel B. Luten of Indianapolis, Ind., and the illegality of the issuance of these patents by the Patent Office.

In this you state: "The committee was duly designated and the first of the hearings set for Nov. 8. Notices of the hearing were sent to interested parties, but despite the fact that interests in Iowa and Kansas were active in securing the passage of the resolution none of their representatives were present at the hearing."

This statement gives an erroneous impression, in that no notice was received by the state highway departments or the departments of justice in Iowa or Kansas, nor was Senator Kenyon of Iowa, who is a member of the committee, notified that the first hearing would be held Nov. 8.

This hearing will begin about the first of January, and Iowa, Wisconsin, Nebraska, Oklahoma and Kansas will have representatives present.

W. S. GEARHART,
State Engineer of Kansas.
Manhattan, Kan.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Clean Boiler Water Secured from Muddy Streams with Well-Points

BOILER water difficulties were acute on the dredges of the California Development Company, which owns and maintains the main canals of the system supplying the Imperial Valley, in southern California and the northern part of lower California, until the superintendent of the river division, H. M. Rouse, hit upon the plan of using a well-point. Previously various devices had been used, the most satisfactory being a large settling tank on each dredge, in which a boiler compound was used, to counteract the slight alkalinity of the water. These tanks, however, were difficult to clean, and at best gave an unsatisfactory water.

The plan hit upon and now used exclusively on the company's fleet of dredges is to jet down a 3-in. well-point, inside of which is the 1-in. jetting pipe. One of these points is hung from a spud-frame of each dredge, and can be jetted down in a few minutes wherever the dredge is working, and pulled as easily for moving. The pipe is jetted down into the channel bed itself, taking care that the screen is well below the channel bed. Thus advantage is taken of the natural filtering action of the stream bed material. When the point is down to proper depth the feed pump, whose suction is attached to the well-point by a hose, is started, delivering directly to the boiler.

Painting a Pipe Line by Machine

A GASOLINE engine-driven machine has recently been developed in California for applying a protective coating to 8 and 10-in. steel pipe after the joints have been made and just before the pipe is lowered into the trench. The pipe line to be treated, belonging to the Valley Pipe Line Company, was 170 miles in length and the cost of applying the paint coats was very materially reduced by fitting up a device that first cleaned the pipe by means of a revolving brush and scraper and then applied a liquid priming coat by means of other revolving brushes.

Two machines of somewhat different type were used, the one for cleaning and applying the priming coat was driven by gasoline engine, while the second, for applying the coat of bitumastic enamel, which is solid at ordinary temperatures, was driven by hand power. The cleaning and priming machine carried a scraper and revolving bristle brush on the front end, while the brushes for applying the paint followed on the rear end, the paint being forced to the outer edge of the brushes by centrifugal force. The entire equipment was self-contained, the 6-hp. gasoline engine which provided motive power revolved all the brushes, and the engine frame carried three tanks, one each for water, gasoline and paint.

A crew of two men operated the first machine, which was attended by three other men operating a long lever mounted on wheels. With this lever the pipe was raised from the 4 x 6-in. wooden skids across the trench provided by the pipe-screwing crew, and as the priming machine moved ahead the skids were replaced behind it.

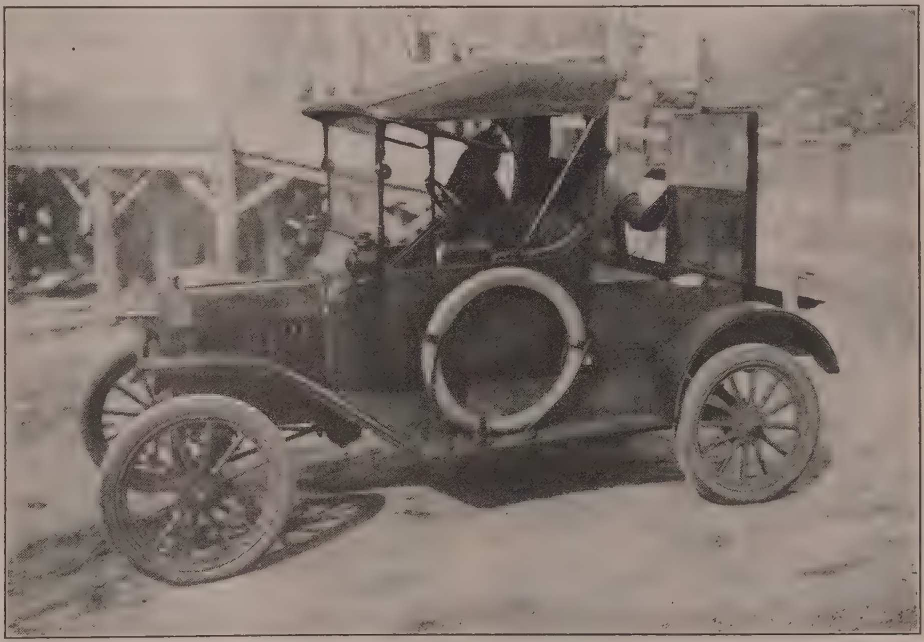
No less than two hours behind the priming machine, which was the minimum period required for setting of the priming coat in good weather, and not more than four hours later, the enameling machine went over the line and placed the 1/8-in. coating of bitumastic enamel. The enameling machine was operated by hand, by turning a crank which caused it to move along the pipe. Large kettles mounted on wheels were used for serving the machine with melted enamel, the kettles being heated by petroleum distillate fuel. After being placed, the enamel coating was retouched where necessary and finally subjected to a rigid inspection, in which a mirror was used for examining the underside of the pipe.

The contract for placing the protective coating was executed by Hill, Hubbell & Company, San Francisco, who developed the machines described.

Pneumatic Drill Closes Doors on Hopper Scow

THE CRANKS closing the bottom doors of a 305-yd., 5-pocket dump scow being used in dredging at Montreal harbor are now being operated with a "Little Giant" drill motor. Although the cranks were designed to operate by hand, and the motor was made to run a reaming and tapping machine, the combination works to perfection. The scow, which is one of those tending a dredge of the Dominion Government, in charge of Captain MacIninch, has pockets closed on the bottom by heavy double doors. These are 8 in. thick, 4½ ft. wide and 18 ft. long. It formerly took six or eight men from 40 min. to an hour to wind up the doors of all five pockets. Using the drill motor instead of the special hand wrench provided with the scow, two men can close all the doors in 20 min. The square shank of the drive shaft, which is geared to the winding shaft, fits, of course, into the chuck of the drill, which is connected by a hose to the dredge. The machine is carried from pocket to pocket till all the doors have been shut.

Oil and Spare Parts Carried to Trucks at Work by This Car



REMOVABLE BOX AND PLATFORM FOR SUPPLIES AND OIL BUILT OVER TOOL BOX

GETTING spare parts, oil, lighting tanks and extra drivers around to a lot of trucks operating at scattered points is admitted by those who have tried it to be a hard job. Its difficulties are materially lessened for Clinton Bretell, whose work is described on another page of this issue, by a small Ford car with a special platform and tool box built on the back end. When the lid, shown raised in the photograph, is shut it furnishes a substantial platform on which an oil barrel, Prest-o-lite tanks, etc., may be lashed. Under the lid next the back of the seat is a locked tool box in which "valuables" like wrenches and brass parts may be transported. Behind this under the lid is a large open space for heavy spare parts.

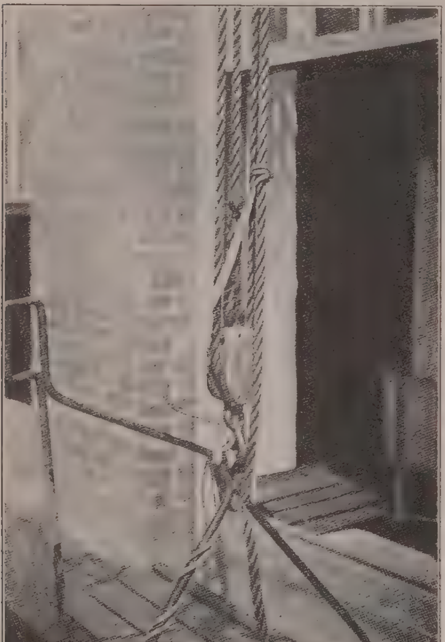
The lid and sides of the box are made of plank with angle-iron corners, which bolt together and to the platform which makes the floor of the box. By taking out a few bolts the three sides and the lid may be removed, leaving the tool box, which furnishes a good seat for two extra passengers. This feature has been turned to good account in carrying extra drivers and mechanics around to the trucks.

This simple arrangement has made it possible to keep the truck drivers on road work supplied with all necessities, without taking their time and that of the heavy trucks to make trips to the nearest railroad station.

Hitch with Sash Cord Prevents Scaffolds from Falling

A SAFETY device which can be rigged in a few minutes by anyone, which is easy to use and which will prevent accidents in raising and lowering scaffolds if one of the men should, for any reason, lose his hold on the rope is shown in the accompanying illustration. The small swinging scaffold widely used by painters, concrete finishers and others is operated by two men, one at each end of the platform. When the scaffold is to be raised or lowered the supporting ropes at the ends of the platform are detached from the hooks to the scaffold, to which they are tied while the men are at work, and each man pulls in or slacks off on his fall, according to whether the platform is to be raised or lowered. Accidents have often occurred from one of the men losing hold of his rope for some reason while it is not fastened to the hook, causing one end of the scaffold to fall and one or both of the men to be thrown to the ground. Although various attempts have been made to find a safeguard for such accidents, the devices hitherto tried have not met with any great favor.

The safety rigging illustrated herewith consists essentially of an auxiliary rope of stout cord at each end of the platform, arranged so as to hold the hoisting ropes securely and prevent them from moving except under the control of the operator. The idea can be carried out in a number of ways. The arrangement shown in the photograph consists of wrapping the middle part of a strong, new sash cord, of about $3/8$ in. diameter, three times around the free part of the supporting fall. The two parts of the window cord are then fastened together near the fall by binding them with stout cord. The hanging ends of the cord are then made fast to the scaffold-iron so that the part that encircles the free rope of the main fall can stand at a height of about 4 ft. above the platform when the cord is extended. In raising or lowering the scaffold each workman grasps the free end of the fall at his end of the platform in such a way that one of his hands holds the part of the window cord that encircles the fall part. As he shifts his hand up or down on the rope, he slides the loop of cord along it at the same time. If either workman should lose hold of the supporting rope, the end of the scaffold where he stands will descend a few inches until the window cord is drawn taut, when the stopper-hitch of the window cord around the free part of the main fall will prevent further movement. The danger in using this device is that the men may come to rely on it to hold the scaffold while they are working. The free end of the supporting rope, however, should invariably be hitched in the usual way. Unless this is done, the advantage of having two fastenings will be largely thrown away.



SAFETY HITCH MADE WITH SASH CORD

This device was originated by the Royal Typewriter Company of Hartford, Conn., and in experiments conducted by the Travelers' Insurance Company proved to be capable of performing its functions satisfactorily and with certainty.

Pile Driving with a "Can"

By P. L. McGEADY
Wilkes-Barre, Pa.

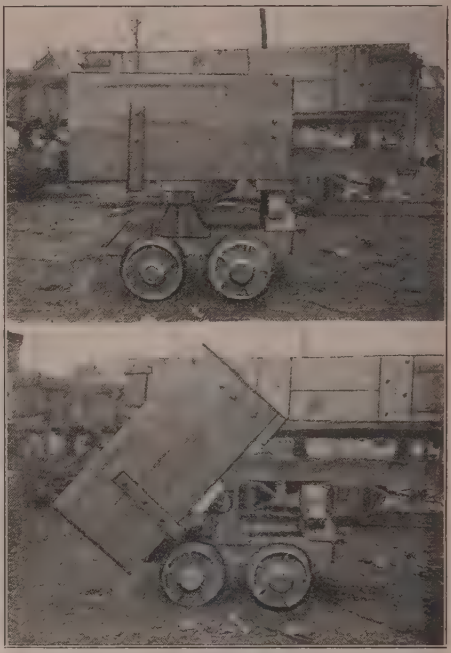
PILE-DRIVING contractors are more or less familiar with the difficulty encountered in driving piles in deep water to cut-off, when the cut-off grade is much below the water surface, and the tedious operations made necessary in cutting off piling not driven to grade. These difficulties may be practically eliminated by use of what may be termed, for want of a better name, a "can." Though the use of this device is not new, the saving it makes over using a simple follower and its general advantages are not usually appreciated. The "can" consists of a steel or wrought-iron pipe having a diameter a few inches larger than both the largest pile to be driven and the follower to be used in driving the piles, and having some means for attaching a chain or cable to one end so that it may be readily handled. An extra pile line on the rig saves time and facilitates the double handling, but where this cannot be readily installed the utility of the "can" is sufficient to make its use worth while, even in very strong currents. Here it is often necessary to guy the pipe to prevent it from tilting over while the follower is being picked up and lowered into it, and also to keep it plumb while the pile is being driven home.

After the pile is set, the "can" is placed over it and the pile driven home with the follower. The "can" is then picked up and used on the next pile. It is often found advantageous to start several piles before using the pipe and follower and then drive all these home, after which the rig may be moved back and another set placed and driven and this procedure continued to the end. This method insures speed, but requires a great deal of care on the part of the foreman to prevent skipping any of the piles. This is a very easy thing to do, since, usually, the tops are already submerged.

This method was used on the foundation for a dock wall recently completed at Toledo, Ohio, where piling was driven to cut-off at a depth of 24 ft. below normal water level. When the cofferdam was pumped out and the excavation completed, it was found that the piles were so nearly uniform in grade as to require cutting off less than 3 per cent of those driven.

Well-Balanced Dump Cars Made on New York Subway Contract

HALF-A-DOZEN end-dump cars of the type shown in the photograph are saving expense in taking out the earth top headings of a deep cut on 138th Street, west of Second Avenue, in constructing the west branch of the new Bronx subway in New York City. Three cars are used on parallel tracks in each heading. End-dump cars are desirable for this work, as they can be loaded from the rear side, run back to the edge of the bench and dumped down chutes on the face of the lower cut without requiring trestlework to run them out over cars on the lower level. As is well known to those who have used them, cars of this type are hard to balance so that they will dump easily and not kick off the track. These cars, however, dump without trouble and do not require holding down with that nuisance necessary to badly balanced cars—a lever through the truck frame.



CAR DOES NOT TURN OVER WHEN DUMPED

The cars were built of timber, using old wheels and dump-car castings at hand on the job. All the material except the oak lumber used would be considered scrap, so that the cars were provided for little more than the labor used in making them. They were designed by H. R. Shailer, general superintendent for the Richard Carvel Company, Inc., on whose section they are being used.

SAND SHOULD ALWAYS BE TESTED, according to Sanford E. Thompson in a paper on "Concrete Aggregates" presented before the International Engineering Congress. A table of results of actual tests showing variation in strength of mortars made with different sands compared to standard Ottawa sand is given in proof of this conclusion. The most satisfactory test is the determination of the strength of the mortar made up with the cement and fine aggregate to be used on the work in comparison with identical specimens made in the same proportions with standard sand.

Adequate Railway Systems a Basic Element in Military Preparedness

George Dallas Dixon Tells International Trade Conference How Pennsylvania Lines Could Serve in Case of War

UNLESS the railroads of the United States can be depended upon for the transportation of huge numbers of men and vast quantities of munitions and supplies, in the event of a threatened attack by a foreign power, any plan of preparedness involving the Army and Navy exclusively will be incomplete in one of its most vital features. This, in effect, was the contention of George Dallas Dixon, vice-president in charge of traffic of the Pennsylvania Railroad, made in an address delivered Dec. 6 at the International Trade Conference in New York City. Taking the Pennsylvania system as an example, Mr. Dixon explained in detail the service it could render, with its trained force of 200,000 men, including 700 civil engineers and 200 mechanical engineers, if war should be declared. Arguing on the ground that the railroad is a military necessity, as shown by the events of the war in Europe, Mr. Dixon made a plea for treatment, on the part of the federal and state governments, which will insure the healthy growth of the common carriers. His address, slightly condensed, follows:

TRANSPORTATION A MILITARY QUESTION

"It has often occurred to me that in all the discussions of preparedness one of its most important phases, possibly its most important—transportation—has been overlooked by the majority of people. It is every bit as important that our railroads should be prepared for national defense as it is that our Navy and our Army should be prepared. As we are virtually pledged against another war of aggression, our military plans must necessarily be plans of defense, with a greater navy, primarily, and a greater army, secondarily, as the most obvious needs. There is danger, however, that the very obviousness of these necessities in any plan of preparedness may blind the eyes of Americans to another necessity, which is less obvious but by no means any less vital, and that is, adequate preparation for the mobilization and co-ordination of the internal resources of the country. This means good railroads. Not merely as good as we have now, but better. Suppose that a hostile army was about to invade our land. What part would the American railroads play in the scheme of national defense and what would be expected of them?

VALUE OF RAILROADS IN PREPAREDNESS

"There are, to be sure, abundant commercial reasons why it would well repay the American people to conserve and encourage their railroad systems and make their more rapid expansion and upbuilding possible. Well-constructed, well-equipped, properly manned, skillfully managed and solvent railroads are necessary to a healthy state of business. But as a military resource, a vital element in preparedness, they would be valuable beyond the possibility of expression in terms of money.

"During the period from which we are just emerging, when business was, to say the least, quiet, our railroads were unable, for financial reasons, to improve their properties in anticipation of a return to what I might call a prosperous era. Their earnings were not sufficient to warrant investors in supplying the capital needed to provide facilities for a greatly enlarged traffic, nor were they enough to enable the roads to put by a surplus for better cars, heavier bridges, more modern signals, and all of those things which go to make up a good railroad, but which, except to a very small extent, do not increase a railroad's earning power. Private capital is ready to-day to invest in our American railroads and needs only the assurance that the people and the government wish to see it allowed a fair and reasonable return. Just consider how helpful it would be now to the country's welfare if our railroads had the facilities needed at this very moment to handle our export commerce—I might almost say, under existing circumstances, the world's commerce.

"Certainly the present situation in which the railroads of this country find themselves should be adequate proof to the people that our railroads should be prepared for any possible emergency, whether it be to handle an extraordinary quantity of traffic such as is now being offered for transportation, or for any extraordinary service the government might call on them to perform. The very existence of the nation, in the unhappy event of a war, might well hinge upon the ability of our interior transportation systems to bear the tremendous burden that would be put upon them, without collapsing. To be certain of so doing, they need great strength, much more than, as a whole, they have to-day.

WAR'S LESSONS IN EUROPE

"The war in Europe has taught no surer lesson than this, that great forces of men, however courageous or admirably trained, are of little military value without the means of moving them with promptness and order and of keeping their many needs continuously supplied. This means transportation facilities that can be counted on to work with the smoothness and certainty of a machine. Without such facilities, all other preparations are useless, and the effort put into them wasted. The railroads have played an important part in all the great wars of the last three-quarters of a century, that is, in every principal struggle of nations and rulers since the wars of Napoleon. But never before have they assumed the importance that they hold in the present war. Practically every great campaign in Europe during the last fourteen months has centered, at some crucial stage, about the possession of a railway line or junction point, control of which meant rail communication, or the loss of it, for one side or the other. The whole land campaign in the Balkan states, and the intricacies and ramifications and intrigues of diplomacy that have accompanied it, resolve themselves into a struggle, on the one hand, to establish a line of railroad communication between Central Europe and Turkey, and, on the other hand, to prevent the establishment of such a line.

"The ability of the Germanic allies, thus far, to exist within the 'iron ring' and not only to prevent it from contracting with a crushing pressure, but to push it back here and there and even to break through it in places, is of course due to many factors, but certainly to none more than to that perfection of plans and facilities for railroad transportation in every direction, at any time, which was one of the principal elements in Teutonic preparedness. By her railroads Germany has kept her armies and material resources liquid and they have flowed from one frontier to another with the swiftness and smoothness of water. The German railroads were built and developed, under a militaristic system, with a first eye for military use. Our railroads were built by private capital to serve the needs of the commerce of a non-militant people, and are in themselves commercial enterprises. This, however, in no way detracts from their value for military purposes, since economic law has seen to it that they connect the centers from which men and supplies must be drawn in case of war.

AMERICAN ROADS' NEEDS

"The American people can make no wiser investment in military preparedness, and can buy no stronger assurance for the preservation of the nation's integrity, than by allowing their privately owned railroads sufficient income at all times:

1. To bring all track and roadway up to standard conditions and maintain it thus.

2. To construct the double, triple and quadruple tracking and to make the terminal extensions and improvements that are required now, by the needs of peace, and which would be of immeasurably greater value if the railroads were ever called upon to assist in military operations.

3. To acquire sufficient supplies of locomotives and cars of modern types, and to reconstruct or replace all obsolete equipment.

4. To hold in the service a sufficient number of well-trained, well-paid and satisfied men, both officers and employees, to assure prompt and efficient operation in any emergency. Some railroad systems are substantially in this condition at the present time, but many, less fortunately situated, are not. If all were enabled to become so, within a reasonable time, the nation would be possessed of a military resource of inestimable value.

THE PENNSYLVANIA SYSTEM

"Take the Pennsylvania Railroad system, with its associated lines, and consider what part it could play and what it could offer the nation in time of need. In the first place, it could offer a trained and disciplined army of more than 200,000 men for the performance of those indispensable transportation services without which the army and navy forces would be helpless. It would probably not be within the province of any railroad management to decide where its men could perform the greatest service—on the battlefield, or in engine, train and shop—or to interfere with personal freedom as to enlistment, but the government would no doubt decide that every consideration of wisdom lay in maintaining the organization of this and other railroad systems substantially intact. The English railroads sent a considerable number of men to the trenches early in the war, but in the first few weeks of the struggle England learned the value—indeed, the absolute necessity—of unhampered transportation, even though the actual battlefields are not on British soil. Both England and France have learned the lesson of the extreme unwisdom of sending to the front those men who have the special mechanical and other training and experience needed to keep up with the enormous demands made upon the national resources for production and transportation.

"The Pennsylvania Railroad could offer the nation a physical transportation system which handles the most extensive commercial railway traffic in the world—a system embracing more than 11,000 miles of line and over 26,000 miles of track, with terminals in the three largest cities of the country and in eight out of ten largest centers of population. This system operates only about one-twenty-fifth of the total mileage of the country, but it carries almost one-eighth of the freight traffic and more than one-eighth of the passenger traffic. The railroad's rolling equipment consists of the following: 7500 locomotives with a combined tractive power of 250,000,000 pounds; 7000 passenger cars, with a carrying capacity of 330,000 people; 275,000 freight cars, with a carrying capacity of 13,000,000 tons.

"The locomotives owned by the Pennsylvania have power sufficient to haul, simultaneously, over any ordinary grades, soldier trains of 100,000 cars in all. These trains could move an army of from 5,000,000 to 6,000,000 men and would fill a stretch of track as long as the system's main line from New York to Washington and from Philadelphia to Chicago. No simultaneous movement of men on such a scale would be actually possible, but the figures give some idea of the extent of the transportation facilities of one system which would be available for the service of the nation.

"In addition to carrying facilities, this system has vast shop resources and a great body of skilled mechanics. The railroad shops at Altoona, Pa., alone—the largest of their kind in existence—employ 12,000 hands, a large proportion of whom are highly trained machinists. Counting all the shops on the Pennsylvania system, the total of men who might be called upon for specialized service is 64,600.

Civil Engineers Invaluable

"The road has in its service many other men highly trained in the professions and trades, or in special duties which from the standpoint of preparedness might make them invaluable to the nation. There are in the service of the system over 700 civil engineers, all of whom have had experience—many of them years of it—in railroad construction and maintenance. Think of the value of these men to the country in directing the work of planning and building the special railroads and bridges that would be required for military purposes. On the payrolls also are 200 mechanical and chemical engineers, who direct the motive power work at the various shops and round houses, including the repair and construction of locomotives and cars, and supervision of the testing of materials. These men could as readily turn their ability and technical knowledge to military purposes.

"For military purposes all of our railroads would have to be regarded from the viewpoint of their possibilities as one system, and the nation can ill afford to allow any part of this country-wide system of 250,000 miles of steel highways to deteriorate or to continue anywhere impoverished or inefficient, for what I have said of the importance to the nation of the Pennsylvania applies, in a varying degree, to all railroads. Next, to an adequate army and navy, if not indeed of equal importance, is the condition of the railroads of the United States as a factor in national preparedness. Only railroads of the highest efficiency can truly unify the country and keep its resources of men, money and materials in a liquid and mobile state. As a military precaution, if for no other reason, it would be in the highest degree wise and profitable for the American people to see to it that their railroads have sufficient financial resources to be able to serve this end properly, and that the federal and state governments accord them treatment which will insure their healthy growth at all times."

Large Baltimore Drain Has Multiple Harbor Outlet

Necessity for Reducing Velocity of Storm Flow Caused by Mooring of Vessels Near Discharge Point

IN DESIGNING the storm-water drainage system for the city of Baltimore one of the large problems which presented itself to Calvin W. Hendrick, at that time chief engineer of the Sewerage Commission, was the relief of the Harris Creek or Harford Run intercepting drain. This drain takes care of the entire flow of the Harris Creek, Upper Harford Run and Ogiers Run drainage areas, or approximately 2371 acres. The lower portion of the drain was known to be inadequate, with a large part of the tributary drainage area only partially developed.

After careful study it was found that if the drainage area of Ogiers Run, the major part of which lies outside of the present city limits but drains toward and into the city, could be intercepted by the construction of a relief drain, the present Harris Creek drain would be just adequate to take care of the drainage area of 1621 acres for which it was primarily designed.

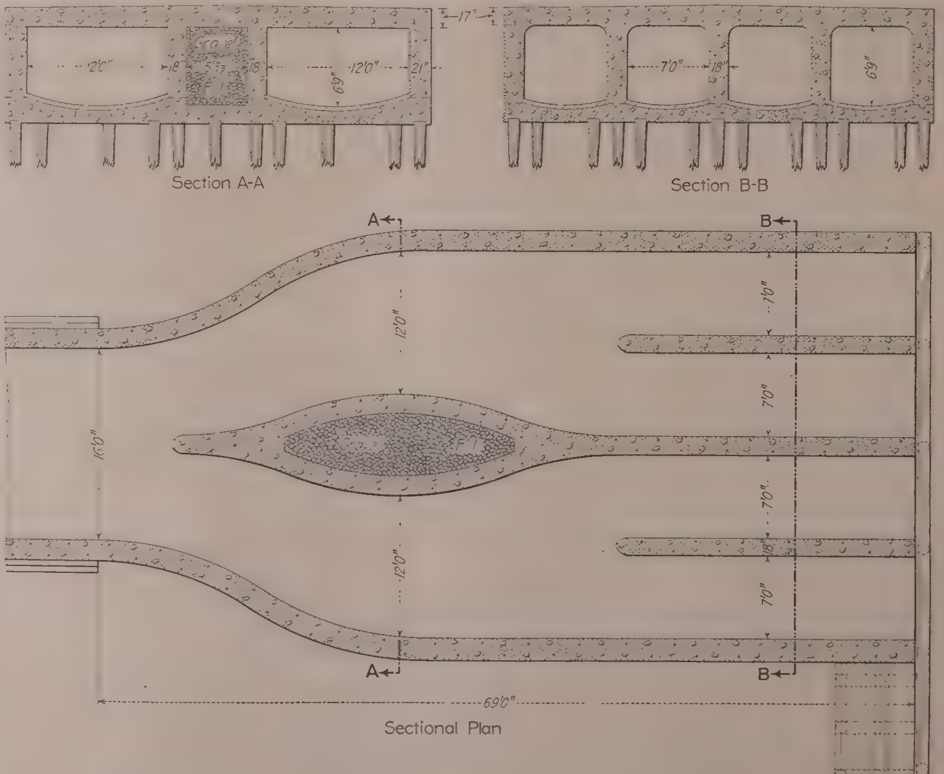
The Ogiers Run drainage area of 750 acres is largely undeveloped but its future development promises to be very rapid, and it was decided to put the relief drain under construction as soon as the necessary right-of-way along the waterfront could be acquired. The major portion of the drain, located in the bed of Linwood Avenue between O'Donnell and Lombard Streets, was completed as section 1, pending the acquisition of the necessary right-of-way for the outlet section, known as section 2.

Types of Construction

Section 1 consisted of 4236 lin. ft. of 147-in. concrete drain, 2000 lin. ft. of which was constructed in tunnel. The outlet section consists of 530 ft. of 147-in. concrete horseshoe drain, 200 ft. of 192 x 81-in. reinforced concrete rectangular drain and a multiple outlet section 70 ft. in length.

As the outlet discharges through the harbor bulkhead, which is used for the mooring of vessels, it was necessary to lower as rapidly as possible the height of the storm flow in order to reduce its velocity and at the same time lessen its effect after its issuance from the drain. The multiple outlet consists of four short tubes, each 7 ft. wide by 6 ft. 9 in. high, with an invert elevation at the bulkhead line of —2.0. The outlet structure is built on wooden piles, with a row of concrete sheet-piling at the bulkhead line, the purpose of which is to retain the fill under the drain and back of the bulkhead. The necessary fender piles for the proper protection of the bulkhead against damage by vessels are also provided.

As the lower portion of the excavation is considerably below the tide level of the harbor a large cofferdam at the outlet is necessary, and the excavation is unwatered by means of two 6-in. centrifugal pumps electrically driven. The contract price of the work is $58,134.35. The contractor is the Raymond Concrete Pile Company, of Baltimore and New York. Alfred H. Hartman, division engineer, was in charge for the Baltimore Sewerage Commission.



LARGE DRAIN IN BALTIMORE HAS MULTIPLE OUTLET IN HARBOR

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Blow-Out in East River Tunnel Result of Difficult Ground

The blow-out which occurred at 9.30 p. m., on Dec. 1, in the south heading of the Old Slip tunnels being built under the East River in New York City was not a serious one, aside from delaying the work in one heading for a short time. It resulted directly from the very difficult and unusual condition of having rock over most of the tunnel face with three feet of mud at the top. This formation makes it necessary to do blasting with the constant danger of disturbing the thin cover of mud over the shield.

While the shields of these tunnels are in rock, bottom headings 6 ft. wide by 5 ft. high are being driven in advance of the shield. In this a concrete cradle is laid, with embedded steel rails on which the shield slides. When 150 ft. of this heading has been driven, work in it is shut down and the shield is advanced till it reaches the end of the section. The shield is then stopped and 150 ft. more bottom heading and cradle completed. In advancing the shield, the rock is shot into the bottom heading. As the rock is seamy, it is necessary to carry 15 lb. of air pressure to balance the full hydrostatic head at the bottom of the advance cut. At the time of the accident a section of bottom heading had been finished, and the shield had advanced to within 120 ft. of its end. It is thought that the light blast fired in the rock section above the bottom heading just before the blow-out loosened the mud above and in front of the shield, reducing the 15 ft. of cover at that point so that it was possible for the air pressure to blow out into the river.

When the blowout occurred there was an outrush of air at the shield, which caused the air pressure in the tunnel to drop to 11 lb. Water and muck began to come in and, although every effort was made to hold the heading by throwing bags of sawdust into the blowhole it soon developed that the escape of air could not be controlled. No one was injured, although the crew remained in the heading until the water forced them to retreat to the emergency lock. Water filled the 300 ft. of tunnel to a depth of several feet.

The hole made in the river bottom was an inverted cone 25 ft. across at the top. Its filling with clay dumped from barges is still in progress, and the unwatering of the tunnel will not be begun until the parallel heading for the adjacent tunnel has been driven well beyond the line of the blowout, so that the same section of river bottom will not be subjected to pressure from both headings at once.

The East River tunnels are being driven by the Flynn-O'Rourke Company, Inc., of which George H. Flynn is president and Major John F. O'Rourke vice-president and chief engineer. For the Public Service Commission for the first district of New York State, Alfred Craven is chief engineer and Robert Ridgway engineer of subway construction. George S. Rice is engineer of the division including the work, and Clifford Holland is engineer in charge of all the East River tunnels.

No New River and Harbor Projects to Be Provided for This Year

No new river and harbor projects will be provided for during the coming session of Congress, according to an opinion expressed by Chairman Sparkman of the Rivers and Harbors Committee, after discussing the subject with President Wilson.

Engineers and Contractors Are Vital Factors in Plans for Military Preparedness

General Leonard Wood Tells Brooklyn Engineers' Club of Technical Man's Importance in National Defence—Engineer Reserve Corps Bill Drafted

Awakened to a new conception of their duties as engineers and as citizens, three hundred members of the Brooklyn Engineers' Club listened until well past midnight to inspiring messages on military preparedness, delivered at the club's annual banquet at the Hotel Bossert, Dec. 2, by Major-General Leonard Wood, Commander of the Army's Department of the East, and other military and naval authorities. Through each of the addresses there ran the same undertone—that the engineer, properly trained in military duties, must form the backbone of any comprehensive plan for national defense.

Carrying with them the weight of authority these utterances were received with absorbing interest, and it was apparent that the straightforward presentation of the facts regarding the present status and future needs of the army and navy aroused in the members of the audience of engineers a realization of a great opportunity to serve their country, not only by individual preparation in the simpler military duties which the technically trained man is best fitted to perform, but also by a nation-wide co-operative movement embracing the intelligent organization of the vast resources which lie dormant, at present, in the engineering profession at large.

That such a movement is shortly to emerge from the visionary stage was made clear by William Barclay Parsons, who, as chairman of the joint committee of representatives of five of the great national engineering organizations, announced that a bill creating a reserve corps of engineers in private practice had been drafted and would be submitted to Congress this month. If this measure is acted upon favorably it may be possible to put into effect next summer a plan of field instruction for the preliminary training of engineer officers for the proposed reserve corps.

The need for such advance planning is a vital issue to-day. This fact was attested by Admiral N. R. Usher, commandant of the Brooklyn Navy Yard, who reminded the engineers that the bulk of the world's wealth is now being amassed in the United States while industrial progress elsewhere has been strangled by the European war. With such a prize as this country to be had for the mere taking—unless the United States is able to defend itself—there would be presented a strong inducement for some foreign power, with fighting forces highly developed and national coffers empty, to strike a swift blow from over seas in order to rehabilitate its own crippled finances.

Military Organization Needed

After an able summing up of the club's purpose in making preparedness the issue of the evening, Nelson P. Lewis, chief engineer of the New York Board of Estimate and Apportionment, acting as toast-master, introduced General Wood, who first emphasized the need of organization in any plan for military efficiency. Transportation, he said, is one of the big factors which concern the engineer, and in case of attack a great load would immediately fall upon the railroads. It would be folly, General Wood pointed out, to attempt to replace the existing personnel of the carriers with army engineers unfamiliar with the details of the transportation problem. The solution is to devise in advance a plan whereby every employee is assigned to specific duty which he is best qualified to perform. Thus the complex mechanism of traffic could be turned from the demands of peaceful com-

Tells Brooklyn Engineers' Club Members of Their Part in Military Preparedness Plans

Photo Am. Press Ass'n.

MAJOR-GENERAL LEONARD WOOD

Testing Materials Society Changes Technical Committees Regulations

The following change in the regulations governing technical committees has been authorized by affirmative action on the part of the executive committee and the committee on technical committees of the American Society for Testing Materials: "As a general policy, only one representative from a given firm, company, corporation, laboratory, or other institution shall be eligible *to independent membership* on a given committee, although exceptions to this rule may be permitted at the discretion of the committee concerned. *If the membership on the committee is held in the name of a firm, company, corporation, laboratory, or other institution, more than one representative may, at discretion of the committee concerned, participate in its activities, with the understanding that such representatives shall jointly command only a single vote.*"

merce to those of war without any extensive reorganization and its resulting confusion. So it is with the other industries—the steel mills, motor truck plants and even the bakeries. The size, capacity, and method of operation of each industry must be studied in advance so that it can immediately be fitted in to the new program which a national emergency might call for.

People are apt to forget, General Wood pointed out, that the men on the firing line are a comparatively small portion of the huge organization which modern warfare demands, and that the actual fighter must be supported by men miles back of the trenches who supply him with clothing, food, ammunition, construction materials and hundreds of other necessities.

Officers Must Be Trained

One of the most vital elements of preparedness, according to General Wood, is properly trained officers. The military and Land Grant colleges and technical schools are producing each year a wealth of material, which, so far as military usefulness is concerned, is absolutely wasted. That is to say, the men who have had this training, some of it excellent and some less satisfactory, but all of it under officers of the Army detailed at the universities, are not gotten into camps of instruction under regular officers in conjunction with regular troops and given that final training which is needed to fit them for efficient reserve officers or officers of volunteers. There is a great opportunity for the large non-military universities of the type of Yale, Harvard and Princeton in the East to inaugurate courses in military art and so train men during the collegiate course that this training, in conjunction with two or if possible three camps of intensive training during the summer vacation, each of about five weeks duration, under officers of the Army and alongside of regular troops, will fit these young men for the lower grades of volunteer officers and, in any case, give them thorough grounding in the essentials of a soldier's training. It seems likely that a number of the country's influential universities will establish such courses and count them as part of the curriculum required for a degree. In fact, a movement is now on foot to standardize the courses of college military instruction throughout the country.

General Wood favors the adoption, in the United States, of the Australian or Swiss military systems, in which a light program of military training is begun in the secondary schools and continued for a few years after graduation at camps of instruction, generally requiring only a few weeks' service each year. The untrained man in war is almost entirely useless, and even if the United States could raise an army of a million men between sunrise and sunset, as certain visionary pacifists claim, the men would merely serve as targets for the enemy rather than as an effective arm of protection.

Military Training for Engineers

Engineers and contractors would be best qualified, with proper training, to direct the construction of defensive works in case an attack were threatened. They know where to get the men and the materials and how to use them, but under present conditions there is no means of organizing these men for the Army's use, in spite of the fact that they would undoubtedly be sought at the first call to arms. If a plan of military instruction were carried out the engineers, when called upon, could at once begin work as officers, with contractors' foremen and shift bosses, all selected well in advance, serving as their sergeants and corporals, thus preserving, in effect, the very features of organization and team-work under which successful construction contracts are carried out. But the important part of such a program, General Wood emphasized, is that it cannot be rushed through on a day's notice. Its success must be predicated upon a plan prepared well in advance, so that each available officer may be listed in the War Department's records, assigned a definite task to do and given the necessary training to do it efficiently.

Other phases of the subject of preparedness were discussed by Admiral N. R. Usher, commandant of the Brooklyn Navy Yard, Elmer A. Sperry, authority on the gyroscope and member of the Naval Advisory Board, Commander Jessup of the Navy and Captain Kilbourne of the General Staff.

Bill for Engineer Reserve

William Barclay Parsons' announcement that the joint national committee of civil, electrical, mining, mechanical and consulting engineers, of which he is chairman, has drafted a bill for the creation of a reserve corps of engineers, which will be submitted to Congress this month, was greeted with enthusiasm. The proposed plan is to develop engineer officers from men in private practice, by a brief tour of field service each summer and possibly by a correspondence course during the winter months. Engineers were urged to impress upon their representatives in Washington the desirability of supporting this measure. To a session dealing with preparedness in the abstract the news that the first definite step toward securing the legislation necessary to carry out the plans proposed came as a fitting climax to a memorable meeting.

Chicago Council Ignores Findings of Smoke Report

Five days after the smoke abatement and electrification report of the Chicago Association of Commerce committee had been made public, the city council passed an order directing its railway terminals committee to take up for immediate consideration the subject of electrification of steam railways within the city of Chicago, and to report at an early date such ordinance as in its judgment may be necessary to bring about the adoption of electricity as a transportation power where steam power is now employed.

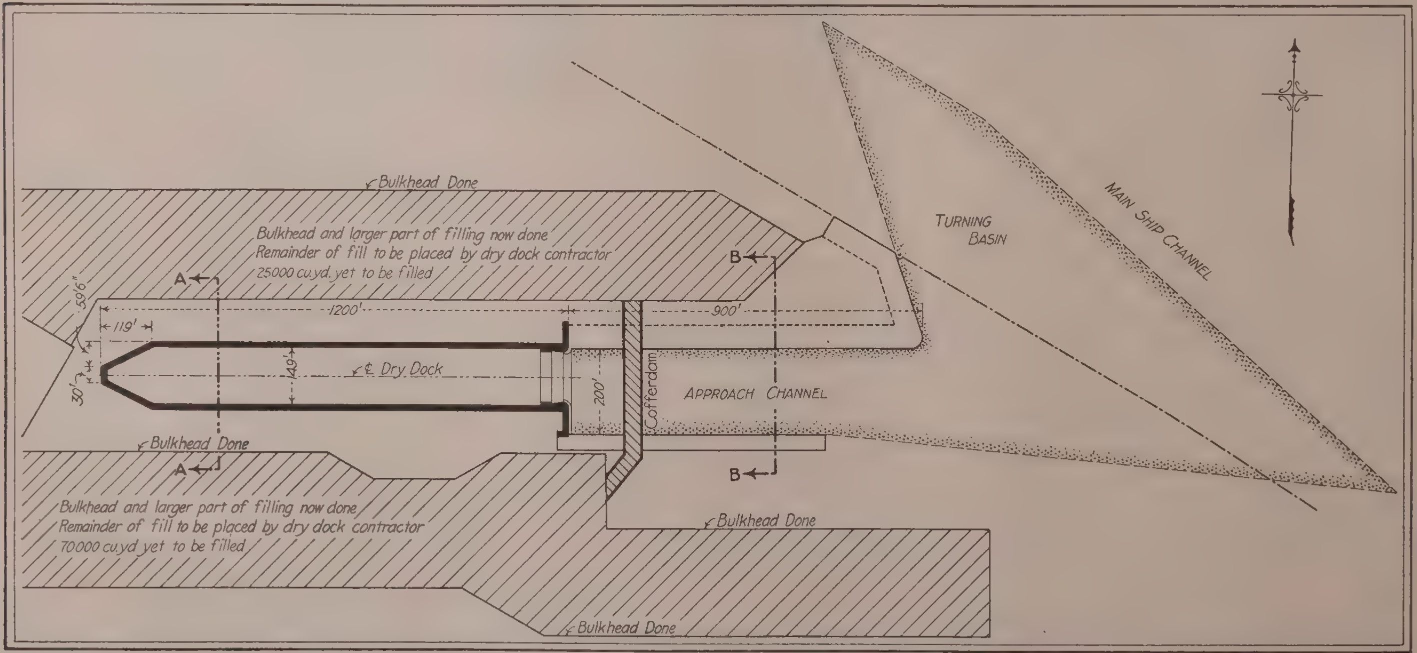
The report was called a disappointment, and the old figure of 43 per cent of smoke as being caused by the railroads was quoted from the 1911 report of the city smoke department. It was held that an annual financial loss of $17,600,000 was chargeable to the smoke nuisance. It was suggested that the matter be taken up first with the Illinois Central and the North Western.

Construction of Largest Drydock Will Require Use of Varied Plant

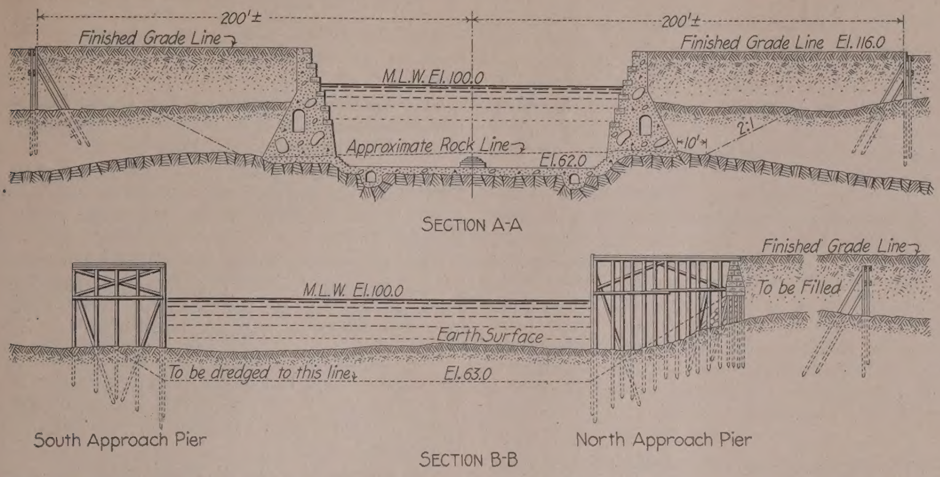
The new South Boston drydock is to be the largest in the country, being 1200 ft. by 149 ft. in over-all dimensions. A wide variety of plant, including cableways, locomotive cranes, compressor plant for drills, mixing plants, a variety of floating plant, and, indeed, about everything but steam shovels, will be used by the Holbrook, Cabot & Rollins Corporation in carrying out the contract.

A dredge is already at work on the site of the dock proper, and Morris & Cummins of New York, who have this part of the work on a subcontract, are expected to bring up one of the biggest dredges on the Atlantic coast, which can handle 150,000 cu. yd. of material per month, and which will make short work of the 450,000 cu. yd. to be dredged from the dock site proper and dumped at sea.

As may be seen from the accompanying drawing, two large areas of land, between which lies the site of the dock and approach channel, have already been made by filling in between recently constructed bulkheads. The


Bulkhead Done
Bulkhead and larger part of filling now done
Remainder of fill to be placed by dry dock contractor
25000 cu.yd. yet to be filled
A
B
59'6"
1200'
900'
119'
30'
149'
℄ Dry Dock
200'
Cofferdam
APPROACH CHANNEL
TURNING BASIN
MAIN SHIP CHANNEL
Bulkhead Done
A
B
Bulkhead and larger part of filling now done
Remainder of fill to be placed by dry dock contractor
70000 cu.yd yet to be filled
Bulkhead Done
Bulkhead Done

LARGE AREAS ALREADY BULKHEADED AND FILLED WILL BE USED TO ADVANTAGE BY CONTRACTORS FOR BIG BOSTON DRYDOCK



FILLS BETWEEN DOCK WALLS AND BULKHEADS WILL TAKE CARE OF MATERIAL FROM BOSTON DRYDOCK SITE AND APPROACH CHANNEL—ROCK NOT EXCAVATED TO FULL DEPTH UNDER WALLS

balance of this fill will be made, after the dock is finished, from the material dredged out of the approach channel. This material will also be used to complete the fill between the bulkheads and the dock walls, after a heavy bank of riprap to be excavated from the dock floor has been placed around the outside of the walls.

About 85,000 cu. yd. of rock must be excavated all over the dock floor. Considerable saving has been effected in the design by the plan of excavating beneath the walls only enough to secure a solid foundation, a sloping blanket of concrete joining the toe of each wall to the floor concrete of the dock.

The Directors of the Port of Boston designed the dock and will supervise its construction. Edward F. McSweeney is chairman and Robert E. Barrett chief engineer. DeWitt C. Webb, civil engineer, U. S. N., has been detailed by the Navy Department at the request of the Boston board to assist in the design and supervision of the work.

The contractors will spend the time until the dock site is dredged assembling plant. Then a cofferdam will be thrown across the lower end of the site as indicated, and the water pumped out. Active work on removing the rock will not start before the middle of next spring. The work is under the direction of Mr. Rollins of the contracting firm, but the name of the man who will have direct charge of the construction has not yet been given out.

Exposition Gates Close After Successful and Profitable Season

The Panama-Pacific International Exposition officially closed its gates at midnight, Dec. 4, with ceremonies attended by record-breaking crowds. The official count of 458,000 admissions on closing day is said to represent, with one exception, the largest number of people ever gathered at one spot in the United States. The total attendance since the opening date has, by far, exceeded expectations, and great satisfaction is expressed by all concerned in the complete success of the project that seemed at one time so seriously handicapped by the European situation.

Closing day exercises began at high noon in the Court of the Universe, when President Moore of the Exposition read a toast from President Wilson and a reply thereto. The meaning of the Exposition and a closing message were given symbolically to all the world by President Moore through a group of young men who appeared on the speakers' platform one after another, each receiving his message and passing out beneath the crossed rifles of the guards. The first of them was a boy scout to whom was given a message to all the children of the world.

Came next a journalist, and to him President Moore said, "To the splendid representatives of the press, who have supported from the first our ideals and our efforts and who have aided in the fruition, has been appointed the great task of carrying the meaning of the exposition to all men. Go, good friend, there is work for you to do." Others who appeared were a toiler in workman's clothes, a cowboy, a surveyor, a soldier and a sailor, and to each was assigned a part in taking the message to all quarters of the earth.

The several palaces were closed by President Moore's party making a tour of the grounds, meeting the chief of each department at the entrance to each palace, where there were a few words of official congratulations after which a herald in the historic costume of the town crier announced the building closed. Prosperity week electrical parade, aeroplane flights and a continuous illumination and fireworks display during the evening were features of the program. At midnight President Moore closed a switch in the Court of the Universe, turning off the lights and leaving the grounds in semi-darkness. This was a signal for a corps of buglers on the darkened Tower of Jewels to sound taps in requiem toward the four points of the compass.

Financial Success

When the exposition period was two-thirds over the last debt was paid off and a surplus began to accrue. After the gates closed on Dec. 4 the total number of admissions recorded was 18,876,000, of which approximately 13,000,000 were paid. In addition to this source of income, a number of the zone concessions, operated on the percentage basis, contributed to exposition coffers.

Reviewing the financial history of the Exposition in a general way, it may be said that the overall construction cost, including ground, totaled about $18,365,000. Prior to opening day assets totaled $16,989,000, so that the gates were opened with a deficit of $1,376,000. The income during the operating period paid all operating expenses and in addition gradually accumulated a surplus which amounted to $2,572,000 at the closing date.

The estimated net cost of restoring the grounds to their original condition is $165,000 and this, plus the deficit on opening day, deducted from the surplus, leaves a net earning of $1,360,000. The Municipal Auditorium, costing $1,086,000 and constituting the bulk of the opening day deficit, was presented to the city by the Exposition as a memorial. The disposal of the net profit from the operating period has not yet been decided upon, but efforts are being made to induce stockholders to assign it to the preservation of parts of the exposition, particularly a boulevard that would follow the present Marina and connect with the Ocean Highway.

The foregoing total cost figures include some 1500 pieces of sculpture and other decorations of the grounds, but take no account of State and foreign buildings or zone construction work and are, of course, exclusive of the 400,000 exhibits that were on display.

Committee Continues Water Problem Studies in California

The question of whether irrigation or navigation should have prior rights was debated at the second session of the California Water Problem Conference which convened in San Francisco, Nov. 29. A paper by Frank Adams, in charge of California irrigation investigations for the federal goverment, pointed out that there are between 750,000 and 1,000,000 acres of land in the State for which irrigation facilities are available but unused. He mentioned also there are over 20,000,000 acres of land in the State that need irrigation, but for which the water supply is nowhere near adequate. In fact, particularly in the San Joaquin Basin, very little more water for irrigation could be developed without storage.

Mr. Adams thought there should be a central authority over water development, instead of the present arrangement whereby six commissions have some voice in the matter. He recommended a more direct State control of irrigation districts which would, he thought, greatly improve the market for water district bonds.

The importance of economical use of water was emphasized by L. A. Nares of Fresno, who said that in his district an excess of irrigation water was damaging the land. Sixty thousand acres had been temporarily rendered useless, he said, by excessive irrigation, which had raised the water table and brought alkali to the surface. A. Griffin of Manteca, agreed with Mr. Nares and pointed out that acre-feet methods of measuring water should be used rather than the second-foot plan.

The suggestion that the office of State water master be created under the direction of either the water commission or the railroad commission was made by W. A. Johnstone of the water commission, as a means for enforcing the economical use of water. This suggestion was very favorably considered by the conference.

W. A. Beard of Sacramento, presented a paper on water storage which took up in detail the question of storage for flood control, for irrigation and for power development. He argued that public rather than private backing should be urged for developing water storage so that all three of these uses could be made more effective.

After reviewing the papers and data which had been submitted to the conference, five committees were appointed to work separately and report again to the conference after digesting all the information received. This work was divided under the following classifications: Committee on riparian rights—to consider various phases of this question and particularly to arrive at an opinion as to the stand of the Supreme Court on the matter; committee on centralization of authority—to consider centralizing all State water authority in one body; committee on irrigation—to consider unification of irrigation laws, duty of ditch water, rights of underground water, and care of ditch systems; committee on State financial assistance to irrigation and reclamation districts—to consider the question of State aid for water districts; committee on flood control, reclamation and navigation—to consider these subjects in the light of safety and most advantageous use of the water, together with State control of storage dams. Still another committee already in existence is investigating water disputes between States.

Theodore Jacobs, president of the State Inland Waterways Conference, announced that Feb. 21, 22 and 23, 1916 had been decided upon for a general convention of water interests in San Francisco, at which would be considered the proposal of C. E. Grunsky to have all California commissions relating to water matters consolidate into a State board of public works. Mr. Jacobs reported having made an extended canvass for this meeting, which would also take up certain other water problems, and said that he expected to have present a total of 1000 delegates from various parts of the State.

$38,000,000 More Wanted for U. S. Public Works This Year

The Sixty-fourth Congress assembled in Washington Dec. 6, and President Wilson delivered his annual address the following day. The greatest appropriations ever asked for during other than a war period were presented by the Secretary of the Treasury in the annual estimates. They totaled $1,285,857,808, an increase over last year of $170,843,614, the majority of the increases being for increased military preparedness.

The total public works appropriations asked for, exclusive of the military and naval establishments, amount to $132,180,157, an increase over last year of approximately $38,000,000. Some of the items under this head are as follows: Public buildings, about $10,000,000; rivers and harbors, $46,000,000; Panama Canal, $19,000,000; reclamation service, $8,938,000; Indian reservation irrigation, $1,000,000; lighthouses, beacons and signals, $2,000,000; Bureau of Standards, $250,000; immigrant stations, $175,000; Alaska railroads, $8,000,000.

For surveys of public lands, $2,220,520 is asked; for the Office of Public Roads and Rural Engineering, $600,000 for salaries and general expenses; for the Bureau of Standards, $50,000 for equipment, $15,000 for the high potential investigation, $150,000 for testing structural materials, $40,000 for investigating fire resisting materials, $10,000 for clay products tests and $120,000 for testing rail materials.

New York Bridge Investigation May Lead to Extensive Reconstruction

It is expected that important changes will result from the investigation being conducted by the joint Senate and Assembly committee appointed during the last session of the Legislature to investigate the condition of highway bridges throughout the state of New York, of which Assemblyman Charles O. Pratt is chairman.

The committee has power to make such suggestions as it sees fit relative to the rebuilding and maintenance of bridges outside of cities. There are 33,000 such bridges in the state, only 11,000 of which have been found capable to sustain a load of more than 8 tons.

The resolution for the formation of such a committee was introduced by Mr. Pratt and was indorsed by the New York State Automobile Association. It is based on the laws, passed since 1887, exempting villages and towns from paying damage claims arising from bridge accidents in certain cases. In 1887 the Laws of New York exempted towns from all liability for any damage resulting from the breakage of a bridge by a traction engine weighing more than 5 tons. In 1890 this was extended to include sluices and culverts and, in 1908, the towns were exempted from any liability resulting from the breakage of a bridge, sluice or culvert by a traction engine, portable piece of machinery or load over 8 tons.

Modern conditions and the advent of the automobile have created new problems, and scarcely a day passes but that loads weighing anywhere from 8 to 20 tons pass over bridges that were built to sustain a load of only 4 tons. In many instances the bridges have been posted to warn people that they cannot safely sustain a load of more than 2 tons. Their location, however, sometimes makes it impractical for the driver to turn back and cross another bridge. This is held to account for many of the accidents which have resulted of late on the state highway bridges. Furthermore, the committee has found that while some of the bridges are strong enough to sustain a weight of more than 8 tons they lack sufficient width to permit the passage of two automobiles at one time, and that the approaches, in many instancs, are in very poor condition and in some cases blocked.

The committee has power to examine all such bridges, as to the method of construction and maintenance, and must make its report on or before Feb. 15, 1916. It is also empowered to introduce such bills as it deems necessary to provide for a uniform method of construction and maintenance of highway bridges and, it is further believed, its report will lead the Legislature to pass laws that will determine which should construct and maintain the highway bridges, the state or the township.

The New York State Automobile Association has taken a very keen interest in the investigation and is aiding the committee in every way. The State Highway Commission is also actively assisting the committee and, while no report is available at this time, it is believed that the investigation will result in a complete change in the method of constructing and maintaining highway bridges throughout the state and in the rebuilding and strengthening of a great many of them.

Philadelphia Engineers Advanced to Important Posts

Speculation as to appointments to the important headships of technical departments in Philadelphia has been brought to a close by the mayor-elect's announcement that George S. Webster, long chief of the bureau of surveys of that city, would be made commissioner of the department of wharves and docks, and that George E. Datesman, principal assistant engineer under Mr. Webster, was to be made commissioner of the department of public works, succeeding Morris L. Cooke. The appointments come as the reward of long, conscientious and valuable service to the city of Philadelphia.

Under Mr. Webster the bureau of surveys has grown from a small department, of a dozen or so men, to a tremendous organization, handling such projects as the $24,000,000 South Philadelphia improvement, the separation of dozens of grade crossings on the Pennsylvania and the Philadelphia & Reading railways, and the preparation of plans for disposal of the city's sewage.

Mr. Datesman, while acting as principal assistant engineer to Mr. Webster and handling a wide range of duties, has given special attention to the question of sewage disposal. In the course of his studies he made a trip abroad and prepared a comprehensive report on practice in European cities.

As an indication of Philadelphia's views on the appointments, the following is quoted from an editorial in the Philadelphia *Ledger:*

"These two appointments are so good that even if the others fell short of public expectation they would entitle the mayor-elect to warm commendation. He has made a promising beginning."

Commission Appointed to Advise on Panama Canal Slides

In compliance with a request from President Wilson, who is desirous that General Goethals have the benefit of the best assistance possible in solving the problem he has in hand, the National Academy of Science has designated a commission to investigate the subject of slides on the Panama Canal and to make a report to the President concerning them. It is expected that the commission will sail for the Canal Zone to-day.

Those appointed on the commission are: Charles R. Van Hise, president of the University of Wisconsin; Brig.-Gen. Henry L. Abbot, hydraulic engineer, of Cambridge, Mass.; John C. Branner, president of Leland Stanford, Jr., University; Whitman Cross, of the U. S. Geological Survey; John F. Hayford, director of the college of engineering, Northwestern University; Harry F. Reid, professor of geology at Johns Hopkins University; Dr. Charles D. Walcott, president of the Smithsonian Institute; Rolla C. Carpenter, professor of experimental engineering, Cornell University; Arthur P. Davis, chief engineer U. S. Reclamation Service, and John R. Freeman, consulting hydraulic engineer, of Providence, R. I.

News of Engineering Societies

The Oklahoma Society of Engineers will hold its annual meeting at Oklahoma City, Dec. 28.

The American Association for Labor Legislation convention will be held at the Shoreham Hotel, Washington, D. C., Dec. 28-29.

The American Concrete Pipe Association will hold its annual convention in Chicago Feb. 17 and 18, 1916, during the week of the Cement Show.

The Engineers' Club of Philadelphia will hold a meeting in that city Dec. 21. Barclay Parsons, consulting engineer, of New York City, will speak on "Railways in China."

The Manitoba Branch of the Canadian Society of Civil Engineers held a meeting in Winnipeg Dec. 2. W. P. Brereton presented a paper on "Grade Separation in the City of Winnipeg."

The Engineers' Club of Trenton held its annual meeting in that city Dec. 9. Samuel T. Wagner, chief engineer of the Reading Railway System, presented a paper on "Some Grade Elimination in Philadelphia."

The American Society of Civil Engineers will hold a meeting in New York City Dec. 15, at which Benjamin F. Groat will present a paper on "Chemi-Hydrometry and Its Application to the Precise Testing of Hydro-Electric Generators."

The South Atlantic Road Congress will be held at Richmond, Va., Jan. 17 to 20, 1916, to determine a policy, devise means and outline routes in a comprehensive road-building campaign in Maryland, the Carolinas, Georgia, Florida and Virginia.

The American Concrete Institute will vote on the following candidates for office next month: President, Leonard C. Wason; vice-president, Henry C. Turner; treasurer, Robert W. Lesley; directors, Charles R. Gow, Edward P. Boyer and J. G. Treanor.

The Brooklyn Engineers' Club held its annual meeting Dec. 9. The following officers were elected for the ensuing year: President, Ernest M. Van Norden; secretary, Joseph Strachan; treasurer, Harry E. Funk; directors, Bernt Berger and Carrol S. Dunphe.

The American Waterworks Association's New York section will hold a regular monthly meeting at the Hotel Manhattan, Dec. 15; luncheon will be served at 12.30 p. m. "Filter Troubles" will be discussed by G. E. Willcomb, F. E. Hale, E. M. Hoopes, F. W. Green, G. R. Spalding, Elmer G. Hanahan, S. M. Van Loan and A. A. Tolson.

The Engineers' Society of Western Pennsylvania will hear James W. Rollins, president of the Holbrook, Cabot & Rollins Corporation, engineers and contractors, of Boston, speak on "The Relations Between Engineers and Contractors" at a meeting of the structural section, to be held at Pittsburgh, Jan. 4, 1916.

The Utah Society of Engineers will hear E. C. La Rue, hydraulic engineer for the water resources branch of the U. S. Geological Survey, speak on "The Colorado River Problem" at a meeting to be held in Salt Lake City Dec. 17. The monthly journal of the society will be increased from 16 to 22 pages in order to publish, in full, the papers presented in the future, according to C. J. Ullrich, assistant State engineer of Utah, its editor.

The Seattle Association of Members of the American Society of Civil Engineers received a report on the final form of the articles of association for the Affiliated Engineering Societies of Seattle at a meeting held in that city Nov. 29. The slight changes made in the articles by the joint conference committee were approved and the representatives previously appointed, Robert Howes and John L. Hall, were empowered to act in the matter.

The Engineers' Club of St. Louis will hold its annual dinner in that city Jan. 26, 1916. Dr. Elmer L. Corthell will be the guest of honor. The nominating committee of the club has submitted the following nominations for officers for the ensuing year: President, F. E. Bausch; first vice-president, H. I. Finch; second vice-president, F. G. Jonah; third vice-president, J. T. Garret; treasurer, F. T. Cutts; directors, W. E. Rolfe, O. F. Harting and W. O. Pennell.

The Cuban Society of Engineers will hear Eduardo Beato, formerly engineer in charge of the work, speak on the "Construction of Sea Walls in Havana Harbor," at the December meeting of the society, to be held at the clubhouse, Paseo de Marti, 76, Havana, Cuba. At the January meeting Luis Morales, chief engineer of municipal engineering, Department of Public Works, will present a paper on the sewerage and paving work in Havana, which cost approximately $17,000,000.

The Nebraska Engineering Society will hold its annual meeting at Lincoln Dec. 17 and 18. Papers will be presented on surveys and records, roads, waterworks, irrigation, hydroelectric development and valuation and legislation. Among the speakers will be: Robert Harvey, state surveyor of Nebraska; W. S. Gearhart, state engineer of Kansas; George T. Prince, chief engineer, Metropolitan Water District, Omaha; H. C. Diesem, investigation engineer, U. S. Department of Agriculture; John Hodge, civil engineer, of Boelus, and C. E. Hurd, consulting engineer, of Lincoln.

Personal Notes

Joseph A. Rourke, formerly assistant engineer in the public works department of the city of Boston, has been appointed engineer in charge of the high pressure water service of that city. He was graduated from Worcester Polytechnic Institute in 1887 and first engaged in mechanical and electrical work. In 1896 he joined the forces of the Boston Transit Commission on the studies and designs for the Tremont Street subway. He has been with the streets and public works department of the city since 1901.

William Vernon Kerns, formerly engaged on paving work for the city of Moline, Ill., has been appointed to a position in the office of the chief engineer of the Chicago & Eastern Illinois Railroad.

Walter Anderson has resigned from the office of city engineer of Centralia, Wash., to accept an appointment with the Berger Manufacturing Company of Minneapolis, Minn.

C. A. Ring, consulting engineer for the Brompton Pulp & Paper Company, has been appointed chief engineer for the Deerfield Pulp Company, Mount Mills, Vt., which is constructing a 30-ton sulphate mill. He also continues in his connection with the Brompton company.

A. G. Hillberg, hydraulic engineer, of New York City, has been retained to design the proposed 30,000-hp. hydroelectric plant at the mouth of the White Rock Canyon on the Rio Grande in northern New Mexico, contemplated by the Rio Grande Light, Heat & Power Company, of which Charles G. Wilfong is the president.

Edward N. Lake, formerly in charge of the Chicago office of the Stone & Webster Engineering Corporation, has become a partner, with Fred A. Krehbiel, in the Krehbiel Company, engineers and constructors, Marquette Building, Chicago. Mr. Lake has specialized in electricity and its commercial application with the Arnold Company and Bion J. Arnold, the Western Electric Company, the Chicago Edison Company, the Chicago board of supervising engineers and the Stone & Webster Engineering Corporation. Mr. Krehbiel has made fuel, steam and mechanical engineering and construction his specialties. He also was with the Arnold Company and Bion J. Arnold for several years.

W. L. Hemphill, U. S. transitman, with the General Land Office, has been transferred from Northern Idaho to Southern California for the winter and is now in the Imperial Valley on the execution of public land surveys. For the past four years Mr. Hemphill has been with the Bureau of Lands at Manila, P. I., as cadastral surveyor, but in June was transferred by the War Department to the federal service.

Leonard F. Burrage, Jr., formerly connected with the U. S. Reclamation Service on the construction of Arrowrock Dam, has been appointed to a position with the Miami Conservancy District, at Dayton, Ohio. Mr. Burrage was with the U. S. Reclamation Service for the past 6 years, having been engaged on the construction of the Kochess and Keechelus earth dams in Washington previous to his transfer to the Arrowrock work.

Irwin S. Osborn and Virgil D. Allen have opened a consulting engineers' office in the Rose Building, Cleveland. Mr. Osborn is still retained on the construction of the garbage disposal plant in Toronto, which is practically completed. Mr. Allen was, until recently, building commissioner of Cleveland. The firm proposes to handle architectural, mechanical, industrial and municipal work.

W. D. Beers, state engineer of Utah, has moved his offices into the new State capitol at Salt Lake City.

A. P. M. Fleming, superintendent of the British Westinghouse works at Manchester, England, has been sent to the United States by his government to make an investigation of institutions organized to conduct industrial research. He is at present in consultation with Prof. E. B. Paine, head of the electrical engineering department of the University of Illinois.

Major Wildurr Willing, Corps of Engineers, U. S. A., in charge of the St. Louis district of the Western division, will deliver a series of four lectures on military engineering before the Engineers' Club of St. Louis, beginning in February.

Edwin L. Grimes, consulting engineer, of Troy, N. Y., is assisting James M. Caird in the valuation of Bangor (Me.) waterworks.

John A. Logan of the Logan & Giertz Construction Company of Elgin, Ill., whose appointment as a member of the Illinois Waterway Commission was noted in these columns last week, has been engaged in the contracting business for the past twelve years. The Logan & Giertz company, of which he is president, constructed a large part of that city's sewer system as well as sewers at Sterling, St. Charles and Carpentersville in Illinois, and has done considerable paving work in Elgin, Downers, Grove and Woodstock.

John A. Giles, city engineer of Binghamton, N. Y., has been appointed commissioner of public works, to be effective Jan. 1, 1916. His successor as city engineer has not yet been named. Mr. Giles was graduated from Union College in 1897, and entered the service of the Delaware & Hudson Railroad immediately after. From this work he went to the U. S. Deep Waterway Commission for a short period in 1899 and from that service to work on an electric line from Albany to Thompson's Lake. In the later part of the year he was appointed bridge inspector for the Chicago & Northwestern Railway. After serving as expert computer on New York State Barge Canal surveys in 1900 and 1901, he became assistant engineer for the Chicago & Northwestern Railway, in which capacity, among other works, he had charge of subways, track raising, pavements, retaining walls and the reconstruction of water mains, conduits and sewers in connection with track elevation in Chicago. He was appointed city engineer of Binghamton in 1908.

Norman M. Stineman, assistant engineer, Chicago, Milwaukee & St. Paul Railway Company, was elected chairman of the Chicago chapter of the American Association of Engineers Dec. 3. Other officers are as follows: S. C. Van Etten, secretary, and W. J. Mauer, treasurer.

R. Walter Creuzbaur, of the firm of R. W. Creuzbaur, and Charles L. Parmelee, engineers, Woolworth Building, New York City, has been re-engaged as consulting engineer of railroad improvements for the city of Elizabeth, N. J. Among other works upon which he is representing the city are the six tracking plans of the Pennsylvania Railroad and the straightening of that company's line between Newark and Linden. He is also in charge of the work proposed by the Public Utilities Commission and the city for grade separation along the Central Railroad of New Jersey. Mr. Creuzbaur has been engaged in engineering work since 1877, his first service having been as rodman on the New York elevated railroad work. For many years he was connected with municipal works in New York City, during which period he served for five years as consulting engineer of public works of the Borough of Brooklyn. He was originally retained on the Elizabeth work in September, 1914.

Obituary Notes

J. Herbert Shedd, consulting engineer, of Woonsocket, R. I., and chairman of the Rhode Island State Harbor Commission, died, Nov. 27, at the age of eighty-one. He first engaged in civil engineering in 1856 as a student in a Boston engineer's office. In 1859 he opened an office in his own name in that city, which he continued for 10 years. His first engagement for the city of Providence, for which a large part of his work was done, was in 1866, when he was retained to make an examination relative to a public water supply for that city, and to design a sewer system for the Brook Street district, which was the first step in a comprehensive plan for the entire city. Subsequently, he designed and constructed the Providence waterworks, which cost $4,500,000, and the city sewer system costing $5,500,000. He was appointed chairman to the State Harbor Commission in 1876 and held the office up to the time of his death. In 1890 he was appointed city engineer of Providence, which office he occupied for seven years, after which he was appointed consulting engineer. He became a member of the American Society of Civil Engineers in 1869.

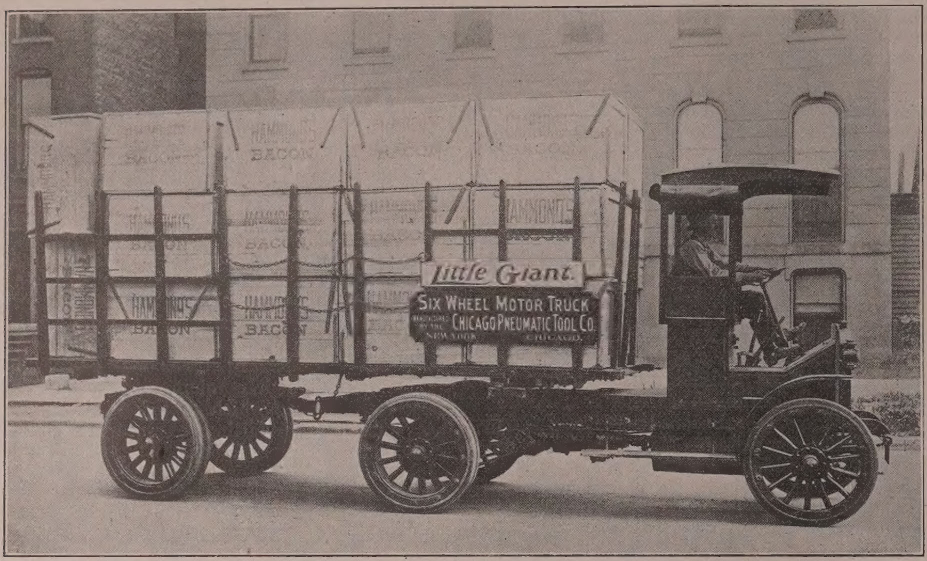
James Mapes Dodge, past president of the American Society of Mechanical Engineers, vice-president of Franklin Institute and chairman of the board of directors of the Link-Belt Company, died in Philadelphia, Dec. 4. He was sixty-three years old. His professional education was received at Rutgers College and Cornell University. During his lifetime he devoted special attention to the improvement and manufacture of conveying machinery and devices. He became a member of the American Society of Mechanical Engineers in 1884 and served as its president in 1903.

O. E. Davis, prominent in the development of the sugar growing industry and organizer of the Stewart Sugar Company, died in New York City, Dec. 4. He was born in Matanzas, Cuba, in 1862, and was educated at the Boston Polytechnic Institute, in this country, and in technical colleges in Germany.

Thomas R. Crowell, city engineer of Lebanon, Pa., died in that city, Nov. 25, at the age of fifty-seven. He was graduated from Lafayette College in 1879 and worked with the U. S. Coast & Geodetic Survey, the Pennsylvania Railroad and, as chief engineer, with the Cornwall & Lebanon Railroad previous to becoming city engineer of Lebanon, about 15 years ago.

Six-Wheel Motor Truck Takes Load Off Traction Wheels

To take the load off the traction wheels and relieve them of carrying and pushing the load, the Chicago Pneumatic Tool Company, Fisher Building, Chicago, has placed on the market the Little Giant six-wheel truck.



TRUCK CAN BE TURNED AROUND IN A 36-FOOT SPACE WITH LOAD OF LUMBER 40 FEET LONG

In the ordinary four-wheel truck the power is applied through the traction wheels and motor truck practice is to place the entire load, or the greater portion of it, directly over or slightly forward of them. The power of the motor is utilized to draw the load instead of carrying it and pushing it, and only sufficient of the load is placed upon the chassis of the truck to secure proper traction. The weight so imposed is not rigidly fastened to the chassis, but rests upon a ball race, making it a live or floating load. This feature is said to relieve the running gear and engine from the shock and strain which a load ordinarily transmits as a result of the constant vibration due to irregularities of roadbed, and also affords relief from strain in starting and stopping. The rear wheels, it is claimed, absolutely track and the driver need have no more concern for the movement and guidance of the load than in ordinary four-wheel construction. It is able to turn around in a 36-ft. space, even when carrying lumber 40 ft. long.

Machinery Exposition to Be a Feature of Drainage Congress

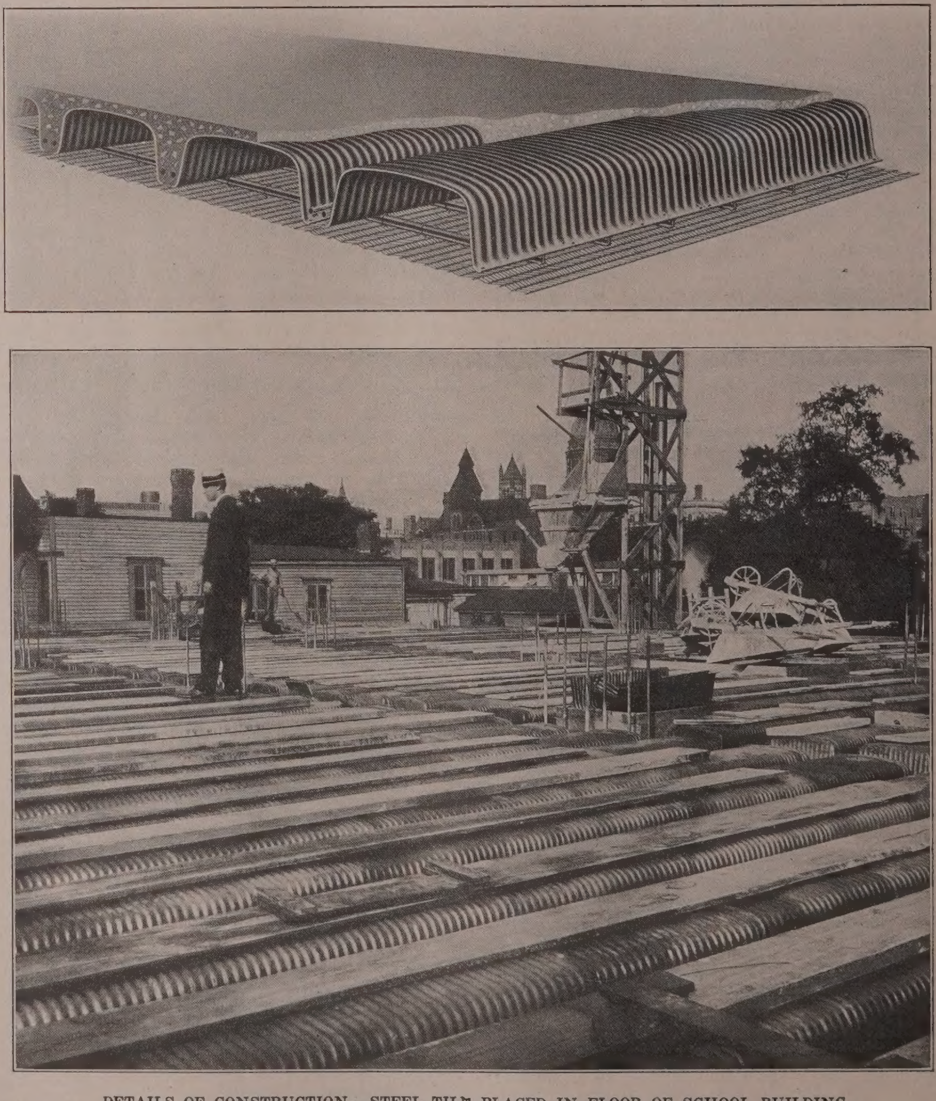
In combination with the Sixth Annual Drainage Congress, to be held at Cairo, Ill., Jan. 19-21, 1916, there will be held an exposition of ditching and dredging machinery and other machines related to drainage work. George Parsons of the executive committee, Cairo, will furnish information in regard to this feature.

New Steel-Tile to Lower Cost of Concrete Floors

Permanent steel forms for concrete floors designed of the T-beam type are being placed on the market by the General Fire Proofing Company of Youngstown, Ohio. In an illustrated booklet of 32 pages, just issued and entitled "GF Steel-Tile—an Economical System of Floor Construction," the new system of construction is fully explained and tables are given for safe live loads on the various sizes of tiles and spacing of joists.

It is claimed that the new construction, examples of which are shown in the accompanying photographs, is particularly effective in such buildings as schools, apartment houses, hotels, office buildings, lofts, warehouses and stores, and that it will result in a substantial saving in cost. The solid steel forms lap tightly at both ends and are joined by a simple but effective centering on the sides, preventing any leakage and waste of concrete. Forms are made of pressed sheet steel and are easily transported without danger of injury.

Form work of simple skeleton timber with runners under the line of joists is illustrated in detailed drawings given in the booklet, accompanied by specifications for both the concrete and the forms. It is claimed that the new steel tiles can be quickly laid. They are furnished in 6, 8, 10 and 12-in. heights and 30 and 35-in. lengths. Cost data will be furnished by the General Fire Proofing Company. Metal lath for ceilings can be easily attached and smooth ceilings obtained.



DETAILS OF CONSTRUCTION—STEEL TILE PLACED IN FLOOR OF SCHOOL BUILDING

Business Notes

The Yeomans Brothers Company, 231 Institute Place, Chicago, has taken charge of the sale and installation of the Shone pneumatic sewage ejectors throughout the United States and Canada.

R. E. S. Gear and John F. Stevens, Jr., have been appointed managers of the Chicago office of the T. L. Smith Company, manufacturer of concrete mixers, of Milwaukee, in the Old Colony Building, Chicago. Mr. Gear was formerly sales manager of Templeton-Kenley & Company, Ltd., of Chicago, and Mr. Stevens was secretary of the same company.

Trade Publications

Kingsford Foundry & Machine Works, Oswego, N. Y. Catalog 18, 6 x 9 in., 24 pages, illustrated. Turbine multi-stage pumps for high duty work. Waterworks, irrigating, fire pressure and boiler feed pumps are shown.

Barrett Manufacturing Company, New York, Chicago, etc. Folder, 10 x 12½ in., illustrated. This artistic and well-printed folder presents reasons why Barrett Specification Roofs were chosen for the National Lamp Works of General Electric Company at Nela Park, Cleveland.